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CHIMÓ: AN UNUSUAL FORM OF TOBACCO IN VENEZUELA*

BY

DOROTHY KAMEN-KAYE**

INTRODUCTION

It is possible for foreigners to live for months or years in central or eastern Venezuela and never hear the word *chimó*. The average Venezuelan in these parts of the country, if questioned about this form of tobacco, shows little knowledge of or interest in it. Nevertheless, a visitor to el Occidente—the west, the Andean states and states bordering on them—sees evidence of the use of chimó everywhere in the form of dark splotches of expectorated saliva on house walls, streets and sidewalks. He will see chimó bought, sold and being used. He may even see it made by either a primitive or a modern process.

The origin of this tobacco paste made with other ingredients goes back to Venezuela's pre-Columbian Indian times. Yet, it is used today—essentially unchanged—by a large segment of the modern, non-Indian population.

Chimó does not fall neatly into the accepted classified

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** Honorary Research Fellow in Ethnobotany, Botanical Museum of Harvard University.

ways of using tobacco: smoking, chewing, eating, drinking, snuffing and licking. It is very closely related in method of preparation to the tobacco concentrate (*ambíl*) of several primitive South American Indian tribes; *ambíl* is licked. The method of use is somewhat similar to that of snuff, especially of snuff-dipping. Yet, in referring to chimó, Venezuelans employ the verb "to chew" (*mascar*) or more often "to eat" (*comer*).

Cooper (20) follows a widely accepted classification of tobacco uses, placing it in the category of licking. He cites Lewin (41), who considers chimó between his discussions of chewing and licking.[1] ‡

For these and other reasons appearing in the course of this account, it is evident that chimó is a very fascinating way of utilizing what William Byrd II of Westover called "that bewitching vegetable". Yet, chimó has, for the most part, been passed over by writers on the use of tobacco. There is very little available on chimó in English, and not much more in Spanish either in the writings of the early chroniclers and their immediate successors or among modern commentators.

The limited area of its use in western Venezuela and adjacent Colombia, plus the fact that it involves both primitive and contemporary factors and therefore does not fit into any one category, may account for this lack of attention.

My reading in both English and Spanish has included material in ethnology, history, botany, economics and travel accounts; the areas of narcotics and drug use in general; and tobacco techniques in particular.

In 1941, I spent several weeks in the Venezuelan Andes, visiting towns along the Trans-Andean Highway

‡ Superior numbers refer to notes at the end of the text. Numbers in parenthesis refer to bibliographic entries.

—Trujillo, Carora, Timotes, Mucuchíes, Mérida, San Cristóbal—observing the preparation of chimó, especially in Timotes, State of Mérida. In 1949, I spent ten days in Boconó, State of Trujillo, interviewing a number of local people and visiting a small chimó manufactory, where several individuals were employed but where machinery was not in use. Consequently, I observed both primitive and semi-commercial aspects of its production. Later, I studied a third aspect—the modern, commercial production.

During 1968–1969, I carried on extensive correspondence with scholars and with several informants in Venezuela, among them a long-time collector of folk customs, resident of Trujillo State.

There are some limitative points in the following discussion of chimó. 1) My informant living in Trujillo stresses the fact that his first hand knowledge of chimó concerns only the area where he lives and that from locality to locality there are variations in preparation and use and in beliefs concerning it. 2) Writers, especially in Spanish, borrow from each other constantly. A statement may, through repetition, gain weight that it does not deserve. 3) As chimó has become a part of the culture of "the people" (*el pueblo*), it has become an element of folklore. Consequently, contradictions form an integral part of the information on its function in society.

Part I

CHIMÓ: WHAT?

Definitions of chimó vary. The Venezuelan lexicographer Alvarado (5) defines it as follows: "Chimó—a soft extract of tobacco, alkalized[2] and aromatized. The alkali chosen is *urao* (sesquicarbonate of soda)[3] or bicarbonate of soda, or else lye made from ashes,[4] obtaining in the

latter case an extremely strong product. The aroma consists of *sarrapia* (tonka bean) or *curía*.[5] In the west (el Occidente) and the lower plains (Bajo Llano), chimó replaces chewing tobacco.—'On Aug. 2 of the same year (1781) mó, chimó and *urao* were included in the monopoly' (Codazzi). Apparently an Andean word, included in Terreros' Dictionary. . . . Synonym, *chimú*.[6] 'On it *chimú* is placed which is the quintessence of tobacco' (Gumilla, II, 222—2nd ed'n)".

The notes on this definition make it obvious that the "what" of chimó is not a simple matter. Describing its preparation by the primitive method, used in household manufacture (*fábrica casera*), from mó to *bojote*—from basic ingredient to packet purchased by consumer—seems the best way of clarifying exactly "what" chimó is.

The basic ingredient of chimó is tobacco in the form of mó or móo. Mó is a thickish brown-black extract of tobacco from the cooking of tobacco leaves in water.

In the 19th Century, Díaz (24) and others, describing the Venezuelan *cura negra* (black cure) of tobacco—as opposed to the more usual *cura seca* (dry cure)—mention mó and chimó as by-products of this process.

The *cura negra* is essentially a process of compression, fermentation and sweating, during which, from ropes of tobacco made into huge balls, there is distilled a thick extract (*ambír*). The method of this cure is very similar to processes employed in the production of Perique in Louisiana and Anduyo (or Andullo) in Santo Domingo (4, 12, 53).

Díaz adds that chimó results when *ambír* is boiled down to a jelly-like consistency and "is used. . . instead of chewing tobacco, taking portions into the mouth, dissolving it there as though it were a caramel".

Today, the chimó-maker (*chimocro* or, less frequently,

chimocero) may also prepare his own mó or—more often—buy it from the evaporator (*mermadór*), who specializes in making mó in quantity. This man, who may be located at a distance from the *chimocero aliñadór* (maker who adds flavoring, etc.), might be the grower as well, of the tobacco used.

In the form offered for sale, mó is also called chimó *en Istú* (*istú*, *ystú*) or crude chimó.[7]

To make mó, fresh or dried tobacco leaves are steeped for hours or even days in near-boiling water, in a large copper or cast-iron cauldron.

According to Wolf (71), a part of the tobacco cured in Venezuela today "is always utilized in making chimó and 'tobacco rapé' ". Cardona (17) quotes an informant from Trujillo State who specifies the use of dry tobacco leaves. On the other hand, Dupouy (27) states that the whole plant is utilized—stems, leaves and roots—which seems to indicate use of green material. Valero (pers. comm.) asserts that, whenever possible, green leaves are employed, since use of dry leaves results in a bitter chimó; he adds that fresh leaves yield more juice.

When the leaves are reduced to pulp and are "exhausted", the mass is removed from the cauldron and squeezed in a crude wooden press. This, according to Valero (pers. comm.) is a double grill of wooden strips tied together with vines, set on a frame of four forked uprights and weighted with stones. The tobacco juice drains into a receptacle underneath and is strained in a bag (*costa*) of *coquiza* (*Fourcroya Humboldtiana*) cording. It is returned to the cauldron to be reduced further.

Mó is put into a variety of containers for sale. The mó for the chimó which I saw made was sent on the bus from Valera to Timotes in a gasoline can.

Preparing mó may be called the first of two stages in

making chimó. Stage two begins when mó is returned to the fire and an alkalizing agent (perhaps sweetening and flavoring as well) is added.

I observed this process in Timotes, Mérida State, where a *cocha* (variant of *cochura*, a batch) of chimó was prepared by Balbina Rámos and her son Juan, well known *chimocros.*

I arrived at Balbina's house early in the morning. In the open patio, a small charcoal fire smouldered. The mó was poured into a round-bottomed cast-iron pot (*caldero*, used in Venezuela for cooking food) and put on the fire to heat.

Cernada (literally "strained") stood ready, in a tall kerosene can. Balbina said that it consisted of equal weights of water and ashes, left to "rest" for three days, then strained.

The one invariable additive to chimó (unless *urao* or bicarbonate of soda is used) is the *cernada.*[8] The word refers either to solid ash prepared for making lye or to the lye-water itself. It is referred to as an *aliño* (seasoning), although it is neither an aromatic nor a sweetener.

This *cernada*—in this case in proportion of about one part to five of mó—was added slowly. The contents of the pot gave off an acrid odor.

As the mixture heated, Juan sat close to the fire, stirring it (*batir*) constantly. Later, he stirred more slowly; when the fire got low, he brought a few coals from the kitchen on a tin shovel. He said that chimó must never be allowed to boil and must be set on a very low fire to prevent its burning. It burns easily and is bitter if scorched.

As the chimó thickened and turned glossy black, it gave off the smell of burned cereal or of cooked sugar. I knew that brown sugar (*panela* in brick form, *papelón* if a cone) is sometimes added to chimó, but I had not noticed anything put in except the *cernada.*

Chimoeros are understandably reluctant to share their seasoning secrets, since their success depends on the distinctive character of their product. Either in Timotes nothing but the *cernada* is added or Balbina managed to hide the fact that she added sugar and perhaps other ingredients to this *cocha*.

Many additives—all of plant origin—are mentioned in descriptions of chimó.[9] When they are listed, the inference is that they are added when the chimó is being cooked. On the other hand, Valero (pers. comm.) states emphatically that *chimoeros* in his part of Trujillo use *cernada* only and that, when various aromatic substances are added, it is done to satisfy the taste of the individual consumer. In any case, flavoring material is dried and pulverized before being added. Tonka bean, for example, is sometimes toasted, then reduced to powder. Valero's statement is substantiated by inference by Cardona (17), who quotes an informant from the same part of Venezuela as Valero on the making of chimó; she does not mention additives other than *cernada*.

When the chimó had cooked for about an hour, Juan tested it by allowing some to hang from his stirring paddle and fluttering his fingers gingerly against it. Later, he put some on a greased shovel to cool, then struck against it with a spoon. He explained that, if it sounds dull, it is not done; when done, it gives a clear sound (*clarito*). The expression "*coger punto*" is used to indicate that something cooking is "ready" or "done"—that is, at the proper stage.

The chimó took nearly two hours to "*coger punto*". Juan exclaimed "*Ya!*" ("Now!") and lifted the pot off the coals.

After it had "rested" a while, and Juan saw that it was not sticky (*pegón*), he made several heaps (*tortas*) of it on a table, where it continued to cool. It was now

dull black, a softish paste that stiffened as it cooled.

With greased hands, Balbina and Juan rolled each *torta* into a long cylinder about an inch in diameter. With greased scissors, these cylinders were cut into segments about two inches long. These segments were wrapped in cut-to-measure pieces of the dry outer sheath of banana or plantain stem (*cascarón de cepa de cambur —de plátano*) purchased by the bundle (*paca*).

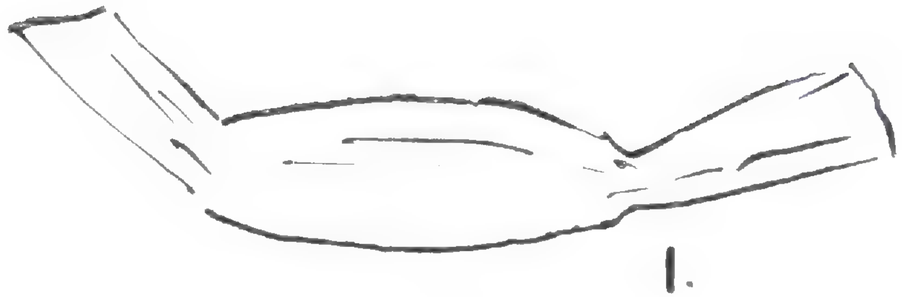
The wrapping of the chimó into a *bojote* (package) is done rapidly, with a flick of the wrist. There is a variety of foldings of wrappers and of wrapping materials, according to locality. (See Plate I.) The finished *bojoticos* (little packages) that Balbina and Juan made, measured about four inches long, including the ends of the wrappers.

The chimó-making process described here represents the smallest-scale chimó production. This chimó is made for family use or to be sold to neighbors a few *bojotes* at a time, or perhaps to a small storekeeper nearby.

Besides *chimoeros* of the "home manufacture" group, there are two other main types of chimó producers.

1) There is the *chimoero* who makes relatively large quantities by the method described above but who employs several helpers. He represents the transition between home and commercial manufacture. In Boconó, Trujillo, Don Tobías preferred to describe rather than demonstrate his process of manufacture. The chimó that he made was wrapped in dry corn husk (*broza* or *coroto de maíz*).

2) There is the manufacturer of chimó who uses machinery as well as helpers. The producer of "Chimó Los Mangüitos" started with a home industry which finally grew into a commercial enterprise. The chimó that he produces is put through a spaghetti machine and is cut by electric knives into sections a little over two inches long which measure only about a quarter-inch in diame-



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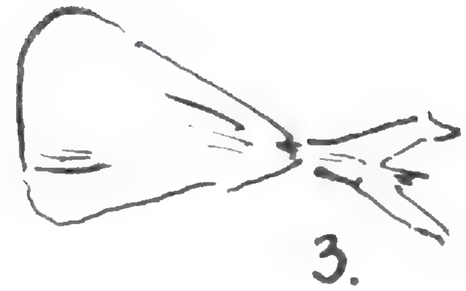


3.

2.

4.

Packages (*bojotes*) of chimó. 1. From Timotes. Material: dried sheath of banana or plantain stem (*cascarón de cepa de cambur o de plátano*); ends sharply bent once only. $4'' \times 1'' \times \frac{3}{4}''$. 2. From Mérida and San Cristóbal. Material: dried corn husk (*coroto de maíz*) tied with strip of same. $2\frac{1}{2}'' \times 1\frac{3}{4}'' \times 3/5''$. 3. From the country near Boconó. Material: dried corn husk. $4'' \times 2'' \times \frac{1}{2}''$. 4. From Boconó. Material: dried corn husk; ends sharply bent and given points, then ends bent again midway of length. $4'' \times 1'' \times \frac{3}{4}''$.

ter. These are wrapped in waxed paper printed with a trademark. Including the twisted ends, this is a unit about four inches long and much more slender than the primitive *bojote*.

Even about twenty years ago, this commercial type of chimó had gained great acceptance, and several brands were available. At present, according to official statistics (pers. comm.), about 20,000 kilos (44,000 pounds) monthly are made by machinery. The best known brands of this type of chimó are made in the State of Trujillo, trademarked "San Benito" and "Carmana".

As long as chimó was essentially a product of home manufacture and consumption in a limited area, the first consideration was quality. As it enters the area of commercial enterprise, two other factors become important: quantity for the consumer and profit for the maker.

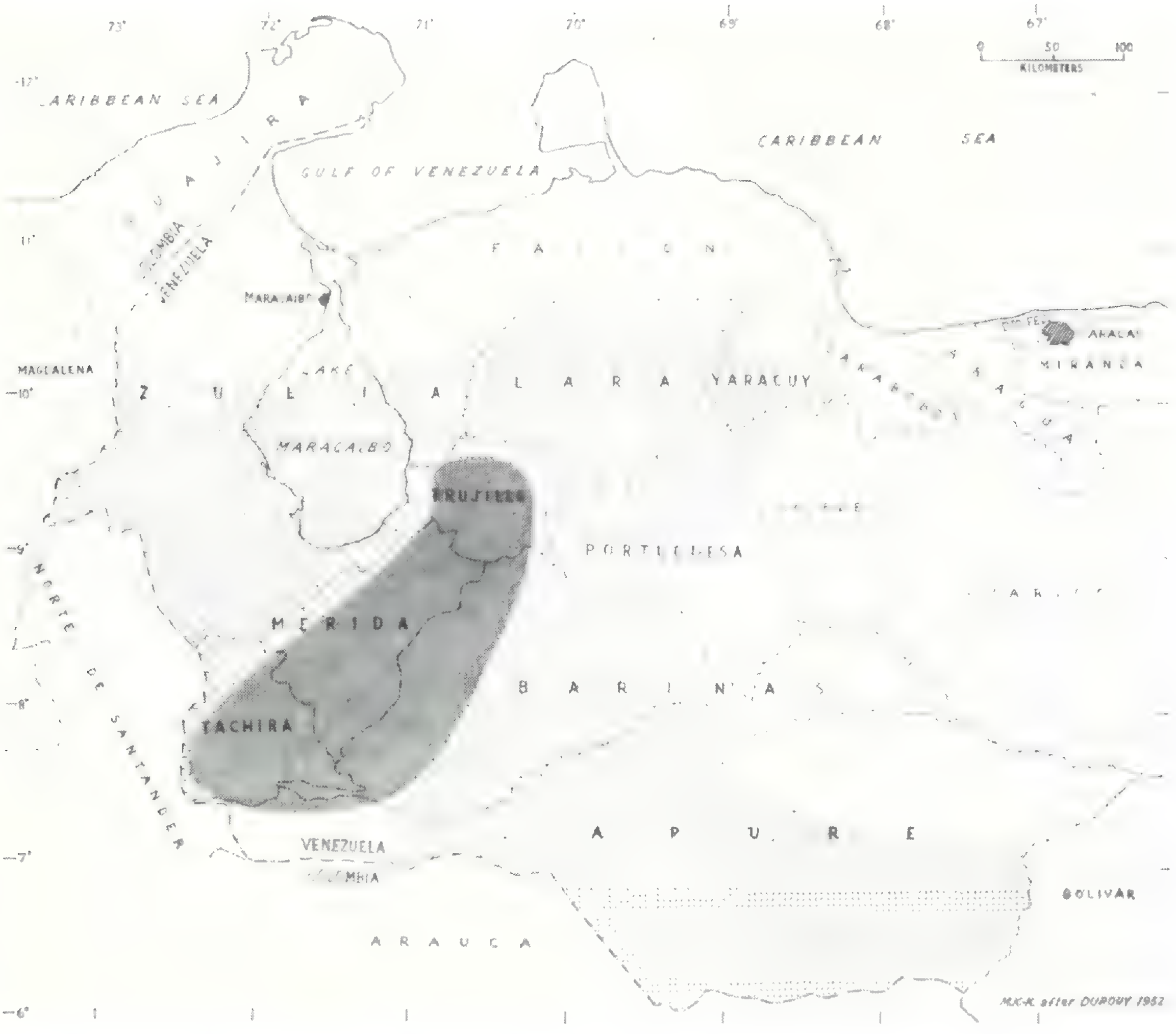
In 1949, a *bojote* of chimó cost one cent (*un centavo*); later, the price went up to two and a half cents (*locha*), where it has remained. However, the quantity of chimó in a *bojote* has dwindled. In some cases, chimó is wrapped in two layers of corn husk or banana stem material "to make it look like something", said a woman in Boconó (39). The machine-produced type of chimó has never seemed to be as much for the money as the primitive type.

CHIMÓ: WHERE AND WHO?

The State of Mérida seems to have been the center of dispersion of chimó in pre-Columbian times, according to Dupouy (27). His map indicates that the post-Columbian use has spread beyond the three other states to which it then extended (Táchira, Trujillo and Barinas) to four additional states: Portuguesa, Lara, Yaracuy and Apure. Cardona (17) correctly adds Zulia to these states (Dupouy, pers. comm.). (See Plate II.)

Chimó is used in a Department of Colombia adjacent

Plate II



Regions of chimó use in Venezuela. Shaded area shows the approximate extent of consumption of chimó in pre-Columbian times; dotted area the approximate spread in the 20th Century; dashes indicate approximate extent of area added by Cardona.
(After Dupouy, 1952.)

to Táchira, Venezuela—Santandér del Norte, where it is called "*chimú*". Reichel-Dolmatoff (pers. comm.) asserts that it is "widely used by the peasants and lower classes" and adds: "In the market of Cúcuta, the capital, one can buy finger-long bits of *chimú* wrapped in paper and even sealed with an official label of the national tobacco monopoly". Schultes (pers. comm.) indicates that chimó is employed throughout the eastern and northern part of the Colombian Llanos.

Venezuela and Colombia have today a long common frontier and their adjacent mountain regions have shared many culture traits, some dating from pre-Columbian times.

Dupouy (27) states that the use of chimó is spreading rather than diminishing geographically. This seems probable, with the increased mobility of the rural population of Venezuela in the past twenty-five years, due to the construction of more and better roads. On the other hand, the appearance of chimó in a certain area need not mean that number of users has increased significantly: it may mean that users have moved from one place to another, taking the habit with them.

While chimó has relatively little competition in the Andean region, in Andes-bordering areas it must compete with two well established uses of tobacco: chewing and smoking. Whether or not chimó is spreading in terms of the acquisition of new users depends also on its advantages in comparison with those of these two rivals.

It is true that in Caracas until about 1945, it was possible to buy chimó (paper-wrapped, the only type available) only in certain neighborhoods to which country people gravitated on arrival in the city. Recently, however, chimó has been stocked in most tobacco-stands and shops all over the city and is sold also in neighborhood "public markets". (17; Dupouy pers. comm.)

The question of who uses chimó or has used it in the past involves some striking facts connected with this curious utilization of tobacco.

Acosta Saignes (1) draws on both the writings of the early chroniclers and 19th Century authors on Venezuelan history in reviewing the Timoto-Cuica culture of the region now included in the States of Mérida, Táchira and Trujillo. He reports that tobacco use was shared by them with other tribes; that it was employed in a characteristic form—chimó (also known as mó); that this use extended throughout the region, even as far as Barinas, where it persists to this day. Whether this use was restricted to certain individuals or was general remains a question. Quoting other writers, Acosta Saignes continues that *urao* was utilized by these Indians in the preparation of chimó (see note on *urao*).

This highland population of hunting and maize-growing Indians was exterminated, according to Wissler (70), by the Spaniards. Over a period of about two hundred years, almost the entire Indian population of the west coast of Venezuela as well as of the highlands was destroyed as colonization proceeded. Initially responsible for this decimation were the Welsers (*Belzares*), a firm of German bankers to whom, in 1529, Charles V ceded the land between Capes Maracapana and Vela with the hinterland. Their occupation was terminated by Royal decree in 1556, but they remained there ten years longer. The Crown stipulated that they must administer their concession and protect the Indians. They disregarded everything but the opportunity to enrich themselves, searching for gold (especially "*El Dorado*") and capturing and enslaving the Indians (64). Many of the Indians were put to work in mines or in pearl fishing before Negro labor was introduced, and many died in this unaccustomed and very hard work.

The Welsers were followed by Spanish colonizers. Indians who resisted their advance into the interior were slain or captured and enslaved.

By the 17th Century, the Church arrived, organized missions and taught the natives agriculture and trades. The result was a kind of *encomienda* system (*encomienda* —a certain estate granted by the Spanish king). This type of *encomienda* was followed by another, in which individuals were given land. The Indians living on it were considered property to be exploited. In both types of *encomienda*, Indians were forced to do many kinds of hard work to which they were not accustomed, continuing the toll of sickness and death among them.

Finally, in the 17th Century, the remaining Indians were collected into villages (*reducción*, a settlement of converted Indians). Miscegenation, which had existed all along, increased under this arrangement (64).

In the following two hundred years, surviving Indians were gradually absorbed into the spreading Spanish civilization and an ever-increasing *mestizo* (half-breed) population appeared. Thus, three elements—Spanish (which became *criollo*, but of pure blood), *mestizo* and Indian—fused, to become the Venezuelan Andean population of today. Throughout its evolution, this population retained many culture patterns—among them, the preparation and use of chimó.

Today, mostly among rural, lower-income people, chimó is used by men, women and boys. It is regarded as a solace to the spirit and a comfort to the body, and around it has grown up a complex of beliefs and customs which are a way of life—a way far removed from the primitive circumstances of its origin.

At some time during the 19th Century, European techniques of tobacco use reinforced the customs con-

cerned in the original utilization of chimó, and it gained acceptance among people of rank and importance who lived in parts of Venezuela where tobacco was grown, and in the Andes where chimó was already a habit (*vicio*).

These European techniques of use were those of snuff-taking, fashionable in both Europe and North America in the 18th and 19th Centuries. It was also the period of greatest development of Venezuela's tobacco industry, when the tobacco produced—especially in Barinas (Varinas)—was world-famous for quality.

If the details of snuff-taking—especially of dipping snuff—are comparared with the use of chimó, many similarities are obvious (10, 15, 21, 28, 34, 53).

Taking snuff was common among elegant people; it was thought to be beneficial to health. At hand was chimó, very like snuff. It was carried on the person in a box; it was allowed to remain in the mouth to be enjoyed, like dipped snuff; it was tobacco with flavoring added, like snuff. It was, in short, enough like snuff to be used like snuff.

According to Briceño-Iragorry (14), "There was a time in Venezuela of a great consumption of chimó. It was used by the élite and the humble, the young girls and the old ladies."

Dupouy (27) states: "Although the country people form the great majority of users. . . there was no lack (although today in decreasing numbers) of people of importance who also had the 'vice' of 'eating chimó'. . . . If the first carry it in a simple leaf or piece of paper, the second carry it in cowhorn (*cacho*). . . . It is rare, but not unknown, that some of the élite 'eat' chimó; above all, the owners of estates (*haciendas*) in the cooler places. This, which was formerly frequent, is not so now. . . . I have known some women—above all aristocratic old ladies—who take chimó, especially in order to sleep."

Pinedo (pers. comm.), a Venezuelan in his eighties, reminisces: "Sixty years ago, I saw mature ladies of the aristocracy of Mérida using elegant containers of sterling silver with little spatulas (*pajuelas*), also of silver, attached by a silver chain, that they used to put a small amount of chimó on the teeth."

Depons (22) observes: "The liquid which is expressed from the tobacco . . . is boiled to the consistency of a syrup. It becomes by this means an object of great consumption among the planters of the interior of Terra Firme, principally in the part of Varinas. The women have a small box, which they wear like a watch, suspended to one side at the end of a cord. Instead of a key it is furnished with a little spoon, with which they help themselves from time to time of this juice, relishing it in their mouths like a sweetmeat. This corresponds to the chewing of tobacco among our sailors."

It is interesting to compare the above account with Billings' (10) description of snuff-dipping among young ladies of fashion in Virginia in the late 19th Century: "For snuff, the ladies have very nice round boxes with lids, which they always carry with them full of black snuff highly but pleasingly flavored. They also carry little brushes or sticks about three inches long with pliable ends; these they wet in the mouth, then dip into their snuff-box, and then place them in the mouth outside of the gums and rub earnestly for two or three minutes." He adds that one of the prettiest belles of Winchester asked him to dip with her, and a daughter of an ex-Governor of the State, "handing me a silver-tipped brush and opening a rosewood snuff-box richly inlaid with gold, politely asked me to 'dip' with her."[10]

CHIMÓ: HOW?

A person using chimó is usually said to "eat" (*comer*),

although the word "chew" (*mascar*) is often used. A portion of chimó is called "a chew" (*una mascada*) as well as "a meal" (*una comida*) or lump or ball (*bolea*, derived from the vocabulary of tobacco curing).

A man offering another chimó usually says, "*Coma chimó, compadre!*" ("Eat chimó, old chap!") (27).

As might be expected in a custom as common as that of eating chimó in Andean Venezuela, there is great variation in details of 1) method of use, 2) types of packaging, 3) buying and selling, 4) accessories of use, and 5) beliefs and attitudes associated with chimó.

Examination of these details will present a clear picture of chimó as used in modern Venezuela.

1. *Method of use.* An amount of chimó about the size of a pea is placed in the mouth with the index finger, to adhere to the inner surface of the lower front teeth.[11] As the paste slowly dissolves, the saliva produced by its sharpness accumulates and must be expectorated.

If the paste be carried in a chimó box (*cajeta*), the chimó is removed with the tip of the forefinger; if in its original package (*bojote*), the amount wanted is either bitten off and transferred to the finger or is pinched off.

A chimó user is seldom without a *mascada* in his mouth: he may consume as many as three *bojotes* a day (39). He takes it in the morning to prevent hunger pangs, if he must wait some time for a meal (*para que el estómago aguante*). Dupouy (27) mentions the common habit of sleeping with a pellet in the mouth.

Chimó is an invariable part of all social gathering and observances: saints' days, weddings, baptisms, funerals, or community celebrations at Christmas, Holy Week, feasts of community patron saints, etc.

Lewin (41) significantly describes the use and effect of chimó as reported by those who take it: "A very con-

siderable adaptation of the organism must have taken place to permit the absorption of this powerful nicotine preparation which is taken frequently and in relatively strong doses." In this connection, I should point out that various types of chimó are available, not all of them of equal strength. Chimó *manso* or *dulce* (mild or sweet) is not so irritating as chimó *bravo* or *fuerte* (fierce or strong), which contains fewer mellowing ingredients and is more toxic (27). Chimó made with *urao* is said to be milder than that made with ashes and has a different taste (5, 39). Moreover, if individuals may be accustomed to chimó from infancy, as has been reported, and since the strength of the chimó can be chosen, the adaptation to which Lewin refers could be quite gradual and less of a shock to the system.

2. *Packaging.* Chimó made by home manufacture or by the small producer, is wrapped either in dried corn husk (*coroto* or *broza de maíz*) or in the dry sheath material of the banana or plantain stem (*cascarón de cepa de cambur o de plátano*). Chimó may be folded into an oblong package (*bojote*) with protruding ends which are folded in distinctive ways, according to the usage in various areas. Approximate measurements of this type are: chimó $1\frac{1}{2}$ inches long: wrapped package length 2 inches: overall length of wrapper material 3 to 4 inches. Another package is box shaped, wrapped in corn husk, tied with strands of husk. Approximate measurements are $2\frac{1}{2}$ inches by $1\frac{3}{4}$ inches by 3/5 inch.

Mass produced chimó is wrapped in waxed paper. In the 1940's, transparent paper was used, and a slip with the brand-name was enclosed. Today, an opaque, heavy waxed paper with the brand-name printed on it, is utilized. Approximate measurements are: length of chimó $2\frac{1}{4}$ inches; overall length of wrapper material with

twisted ends, 4 inches. The chimó in this wrapper has a much smaller diameter than that of primitive manufacture. Dupouy (pers. comm.) learned that buyers of this type of chimó count on only two or possibly three chews a roll, fewer than formerly at the same price.

All these packages may be called *bojote*, but those made with corn husk or banana or plantain material are referred to as *bojote en hoja* (package in leaf). Purchasers of chimó in waxed paper usually ask simply for "a chimó" (*un chimó*). Pinedo (pers. comm.) reports a variant form of packaging: chimó is sometimes wrapped in foil in Sucre State. Valero gives (pers. comm.) an interesting sidelight on the form of *bojotes:* "Not long ago the *bojotes* were tied with a single cord in long strings, and the *chimocros* went out to sell with these strings thrown across their shoulders. These *bojotes* were tied at both ends, and the strings had the form of ladders. These . . . were called chimó *bocadillo*". He adds that perhaps this name was given them because, in this wrapping, they resembled a sweet made with guavas, similarly wrapped, called *bocadillo* (a tasty morsel).

3. *Buying and Selling.* The most direct and casual way in which chimó is sold, unless from the *chimocro's* own house, is in the plaza market of a town or even of a city like Mérida.

In the market, with everything spread out on the ground, women who sit on the ground or men who use small stools (*banquetas*) sell chimó directly from the pot in which it was made. For each customer, they take some up on a paddle, smear it on wrapping material and fold it into the usual package. While waiting for customers, they may wrap a few *bojotes* and place them in a little pile on a cloth at the side of the pot.

Chimoeros may choose to sell wholesale to a shop.

Chimó may be bought in several types of shops, perhaps the most popular of which is the *campesino's* (country man's) substitute for a club, the grog shop (*botiquín*). Here he buys liquor (usually *aguardiente*, liquor of poor quality distilled from sugar cane) by the glass and plays dominoes at one of several rough wooden tables.

Other shops are the large provision store, the *bodega*, or the smaller, humbler general store characteristic of villages or country crossroads, the *pulpería*. These shops may sell either the paper-wrapped or the leaf-wrapped, or both types of chimó.

In Petare, a town on the edge of Caracas, chimó was noticed in the Free Market at a general tobacco stand by Cardona (17). It was the paper-wrapped type and was kept in a closed glass jar "the way candy is kept, so it won't melt (*derretirse*)". This precaution is necessary, since chimó liquefies after about a month and is no longer usable.

From one cent (*un centavo*) in 1942, the price of chimó has increased to two and one-half cents (*una locha*), or one-eighth of a *bolívar* (calculated at standard value of twenty cents).

Since low cost for a highly effective result has been a point in the popularity of chimó, we might speculate on its future should the price continue to rise or the quantity in a *bojote* go down further. Valero (pers. comm.) observes that in Trujillo the younger men are turning away from chimó to cigarettes because of extensive advertising. Venezuela produces several brands, and cigarettes are sold singly as well as by the pack.

4. *Accessories.* Accessories used with chimó are the chimó box (*cajeta*, literally "little box"; also called *cuca*, *chimoera; cachito* when made of horn) and the spatula (*pajuela, paletica*).

The classic material of which chimó boxes are made is cow horn (*cacho, cuerno de res*). Tesser (pers. comm.) states that they also may be made from sections of cane or reed or made of small gourds. Seen here and there in use also are round metal boxes which originally held ointment or pills (27, 39).

Although chimó boxes vary in detail, sizes are rather constant—the diameter of a quarter to a silver dollar, even a little larger.

Acosta Saignes (2), in an illustrated monograph, describes the making of cow horn chimó boxes. He watched an elderly *cajetero* at work and questioned him on each of twenty-seven operations. Working some ten hours a day, this man could produce about twenty *cajetas* a week. He sold them for one *bolívar* apiece. All sizes are priced the same, since the smaller ones are harder to make. He sometimes sold to a shopkeeper who asked a slightly higher price for them.

A *cajetero* buys horns from a slaughter house (*matadero*) at a very low price. His work on this raw material is slow and laborious and requires patience and skill. Most *cajeteros* are elderly men. Their only competitors have been prisoners, who made chimó boxes until recently when there developed a tourist trade in birds and other novelties made of horn.

The process of making chimó boxes is too complicated to describe here. Most boxes have a slightly convex top and bottom, a shape obtained by pressing heated pieces of horn onto a wooden mold. These parts and the rims are made in quantity and are then matched up.

Each box consists of two similar halves fitted together and matched in horn-color. They are selected to fit a little tightly, as the chimó lubricates and loosens them.

Not all boxes have convex sides; some light colored boxes are flat, adorned with simple patterns of circular

incised lines made with a sharp point and filled with red color. The pattern seems to be derived from the use of a coin to produce concentric circles or petal shapes. Boxes may also be inset with mother-of-pearl or other contrasting material.

The spatula (*paletica*, *pajuela*), occasionally fastened to the chimó box lid by a cord or chain (27; Tesser, pers. comm.), may be made of horn, wood, bone or silver. It is utilized instead of the finger tip to apply chimó to the teeth. Boxes with spatulas are decorated, usually by a local jeweller, with inlaid or appliquéd designs in silver to match the chain by which the spatula is attached. This type of box is a luxury.

A special kind of box is made from the tip of the horn and is called *cóngolo* in Trujillo State (Valero, pers. comm.) but *cóngola* in Lara State (27). Shapes adapted to the form of the material are made—birds, fishes (called *caribe*) and other animals.

These zoomorphic boxes are prepared in two halves, so skillfully joined as to appear as one piece and are highly polished. They are engagingly carved with round eyes and wings, etc., drawn with a minimum of lines.

Pinedo (pers. comm.) states that these boxes are made only for sale to collectors of curiosities or to tourists and are not meant for actual use. On the other hand, Valero (pers. comm.), describing their manufacture, adds matter-of-factly, "When the maker has a little artistic skill, he carves a box in the form of a bird or animal." [12]

Chimó boxes are carried by men usually in a trouser pocket. Unless they have a pocket in the dress, women wrap the box in a handkerchief and tuck it into the bosom.

Occasionally, when placing chimó in a box, a user will add a freshly plucked aromatic leaf "to give a better flavor". One leaf, observed in Boconó (39), was said to

be *orozús* (identity uncertain; Pittier lists two plants of this name, both of the Asclepiadaceae and both with attributed medicinal properties for the respiratory tract). Other leaves added are rose geranium (*aroma*, *Pelargonium odoratissimum*), sweet marjoram (*mejorana*, *Origanum Majorana*), sweet basil (*albahaca*, *Ocimum Basilicum*) (Valero, pers. comm.) and *curía* (*Justicia caracasana*). (See note on *curía*.)

It may be of interest to add to this description of the chimó box and its use a commentary by Hiram Bingham (11) who met an old man in Acarigua, Portuguesa State. "He pulled out of his pocket a little horn box about as large as a walnut. It was partly filled with a nasty black nicotine paste which is made hereabouts by mixing the essence of tobacco with a mineral salt found in Los Andes. With a small stick picked up from the ground, he extracted a bit of paste the size of a pea and carefully scraped it off on the back of his upper front teeth. This, he assured me, was far better than smoking. I found that the use of this paste is quite common in the towns on the eastern slope of the Andes."

Here is a case of first hand observation plus evidence of some reading or other enquiry. The details of the stick and the upper front teeth may be in error or may be an example of a variant of the usual procedure, but illustrate the difficulty of getting consistent information on a folk custom.

5. *Beliefs and Attitudes.* The whole field of the use of tobacco is involved in a consideration of beliefs and attitudes regarding chimó, because parallels are to be found in chewing, smoking and snuffing tobacco. There are also similarities with the use of coca (*Erythroxylon Coca*) and other narcotic drugs of South America.

A chimó user, for example, asked why he eats chimó,

replies that it prevents hunger and fatigue. Like coca users, he can delay or even omit breakfast, if he has his little meal (*comidita*) of chimó. He can do more work and stave off exhaustion if he has a chew (*mascada*) in his mouth.

Chimó users insist that it is a "healthy habit (*vicio*)." It enjoys, furthermore, a major role among household remedies. Some of its applications include: to stop a cough, relieve headache, cure dysentery and toothache; it is said also to be good for asthma, influenza, stomach-ache and aches in the limbs (20, 27; Tesser, pers. comm.). In most of these cases, chimó is applied to the affected part. Folk medicine suggests, too, the taking of a little chimó after getting chilled or wet to avoid catching cold (27). Identical cures are attributed similarly to chewing or smoking tobacco.

Common also to chimó and tobacco in general is the belief that it protects and preserves the teeth. Díaz (24) reports: "The custom of cleaning the teeth with tobacco keeps them white and preserves them against decay." Dupouy (27) asserts: "There are those who clean their teeth with chimó because, according to common advice, it results in very pretty teeth. In Mérida, they believe that it protects the teeth as well." Billings (10), speaking of young ladies in Virginia who dip snuff, comments that "tobacco sweetens the mouth." How is it, then, that the teeth of a popular saint of the Andean region, are black?[13] A much-quoted couplet about him—among many of similar content—goes as follows:

San Benito viene,
Viene 'e Boconó—
Con sus dientes negros
De comer chimó.

Saint Benedict is coming,
Coming from Boconó—
With his teeth all black
From eating chimó.

Since Saint Benedict has them, must it not be assumed that black teeth from eating chimó are usual, accepted—even desirable? The fact seems to lie somewhere between black and white, according to Valero (pers. comm.), who points out that many people do not clean their teeth, and that, therefore, the tobacco stains and discolors them without actually turning them black.[14]

A well known use of chimó is mentioned by Reichel-Dolmatoff (pers. comm.) in describing chimó (there called *chimú*) in Colombia. He tells of buying it in the market in Cucutá for use in extracting the grub of *Dermatobia hominis* (*gusano de monte* or *nuche*), the human botfly. The grubs burrow under the skin to develop. (Other species of *Dermatobia* infest animals). The botfly is widely distributed in tropical America.

Gumilla (31), writing of the Orinoco basin in the 18th Century, gives explicit directions—the same as are used today—for removing the grub with the use of chimó: "In the center of the inflamed swelling . . . will always be seen a kind of water that the grub emits . . . on it, chimó is put, which is the quintessence of tobacco, and lacking chimó, put on it chewed tobacco, with which the grub is poisoned . . . then, pressing the flesh with the two thumbs, at some distance from the grub (so as not to mash it) and giving a hard squeeze, the grub leaps out, whole, and all that needs to be done is to heal the hollow it leaves. . . ."

Venezuelan country folk believe that there is something in chimó, chewing tobacco and powdered tobacco that kills the grub. What actually happens is that the air supply is interrupted.

There are other uses of chimó connected with the world of insects and other venomous pests, and the same uses are mentioned in connection with chewing tobacco. Chimó, for example, is applied to the stings of scorpions,

centipedes, wasps, spiders and bees. It is also reported to be a cure for snake bite (17, 27).

Because it is thought so generally valuable, many country people who do not use chimó carry it to cure wounds and for insect bites (Dupouy, pers. comm.).

Chimó not only cures but also protects; its odor is thought to frighten away snakes, wild animals and insects, and if some is held in the mouth, safety is assured (27). Further, if a man be overtaken by a foreboding of evil, his chimó wards off evil spirits. Country people going to and from their little plots of cultivation (*conucos*) habitually carry chimó for these reasons, as well as to consume it (Valero, pers. comm.).

These uses of chimó are reminiscent of the role of tobacco smoke in cures effected by witch doctors (60). Medicine becomes magic in folk beliefs about the curative powers of chimó. Tesser (pers. comm.), listing ills which it supposedly helps, adds that if chimó is applied to the afflicted part in the form of a cross, its efficacy is believed to be increased. Magic takes over when chimó is used to counteract the evil eye (*mal de ojo*)—an idea that Tesser (pers. comm.) advances without details. (This is the only mention of evil eye encountered in the course of my investigation, although belief in it is common in Venezuela. The reason lies probably in reluctance of individuals to discuss the supernatural.)

A magic use of chimó is described by Dupouy (27). On Good Friday night, river waters, said to be "sleeping", are "awakened" by an exorcist who, after keeping chimó in the mouth, throws it into the river. He adds that just as there is the "prayer of tobacco", so among chimó users there are beliefs in its magic properties.

Attitudes toward chimó are difficult to evaluate except by repeated contacts in an atmosphere of mutual

confidence. Short, random interviews elicit everything from condemnation (even from users) to uncritical approval.

It is generally agreed that using chimó is "a dirty habit", because of the necessity of spitting dark saliva at frequent intervals. Because today it is employed by the lower income, largely rural population, it has become synonymous with the life that these people lead —simple and spare—in contrast to the life of privilege and sophistication regarded as upper class and urban.

Older chimó users defend the habit. An old lady in Boconó called it a "healthy vice". She said that she had used it all her life and felt younger every day (39). A man in Boconó pointed to another man no longer young, leading a laden donkey (*burro*) up a hilly street. "Look at him, a strong, vital man (*palo de hombre*). He eats chimó. He ought to give some to the poor *burro*. Look at me. I've been eating chimó all my life; my mother rubbed it on my gums, before I had a single tooth. And I can walk all the way up the mountain, nearly to the *páramo* (very high, cold region) and not be tired!"

Those who take chimó seem to develop the same kind of fond attitude to the habit that pipe smokers feel for a certain pipe or mixture of tobacco. Similarly, there seems to exist a kind of indulgent admiration of the elderly who have the habit.

Mariano Picón-Salas (49) recaptures in a series of essays his youth in Mérida. In one revealing vignette, he tells of an old man on his deathbed, a soldier who had served with Simón Bolívar. Gathered in the room were his nephews.

One of his nephews asked him if he wanted anything more, and the reply could not have been more to the point. 'Bring me my *cajeta de chimó* so that I can enjoy a last chew. It's the only pleasure left to an old man of ninety years.' The Colonel died on his rawhide bed, near his fighting cock and his Ayacucho

sword. Before he died, he stained the wall with his huge expectorations of chimó; and I could feel as only beautiful the way, almost animal, virile, still filled with life and with violent blood, in which the old man yielded himself. I was then a young doctor recently graduated, with my eye glasses, my affected language and my bit of pedantry, and I felt myself very small before this old man—representative of a superior race, with a great deal of '*tabaco en la vejiga*' [15]—who was dying before our eyes.

Part II

Part II of this paper deals with the appearance of chimó in the Venezuelan Andes and its persistence to the present day.

There are at least two theories to account for the presence in the remote past and the use today of chimó in this area. One of these theories is based on the association of chimó with coca and its techniques and the similarities in effect of the two narcotics. The other depends on the method of making chimó and tobacco concentrate, and the similarities of these two tobacco products.

Before these specific problems are considered, it may be helpful to review facts about narcotics in general and tobacco in particular.

Tobacco (*Nicotiana Tabacum*) contains as its active principle the highly toxic alkaloid nicotine (6).

Lewin (41) writes: "From the first beginning of our knowledge of man, we find him consuming substances of no nutritive value, but taken for the sole purpose of producing for a certain time a feeling of contentment, ease, and comfort. . . . These substances have formed a bond of union between men of opposite hemispheres, the uncivilized and the civilized."

According to Cooper (20): "Of the various aboriginal South American stimulants and narcotics, alcoholic beverages and tobacco have the widest distribution, being

practically coterminous with gardening. . . . At the present time tobacco is used in one form or another and for one purpose or another by nearly all the Indian tribes of Middle and South America from Honduras to Cape Horn." He points out two dominant trends in use: marked tribal and territorial expansion and equally marked secularization, and he concludes: "Early use was almost exclusively magico-religious and/or medicinal, but in some regions, as in the West Indies, was pretty surely secular and hedonic as well."[1]

Columbus was offered tobacco leaves along with other articles by Indians off San Salvador in 1492; not knowing what they were, he threw them away. Later, one of his scouts learned from the Indians how to smoke the leaves (34).

The general trend from ceremonial to hedonic use however, is largely post-Columbian and is due primarily to European influence (20).[2]

The use of tobacco by man must be of great antiquity. "Native of tropical America," Ames (6) writes "it is unknown in the wild state. . . . The use of the leaves as a smoking material, as a masticatory, and in the form of snuff, and the knowledge of the necessary fermentation to convert the leaves into an acceptable condition, manifests great antiquity for it as a narcotic."

Of some 41 species of tobacco, only two seem to have been used commonly in the past and are cultivated at present: *N. Tabacum* and *N. rustica* (41). Brooks (15) reports: "The nicotine content of tobacco is highly variable and must have been greater as used by aborigines than today after a long development of tobacco with low nicotine content. . . . This, coupled with deep inhalation of smoke, may explain in part the narcotic effect of tobacco upon American primitives as reported by early observers."

Among most primitive South American tribes of the present, tobacco is not the only narcotic in use. It is often employed with coca or as an alternative to coca; it is utilized in one form or another as an alternative to several other narcotics, all of plant origin, or to primitively made alcoholic beverages.

From tobacco in general to chimó in particular is a short, yet not a simple, step.

Early accounts of primitive Andean Venezuelan tribes who used chimó are meagre, and they vary considerably in detail. A carefully researched contemporary account is that of Acosta Saignes (1). In describing the culture of the pre-Columbian Timoto-Cuicas, he relies largely on the early chroniclers and the work of Jahn and recent writers among Venezuelan authorities. Acosta Saignes lists chimó (and *urao*) among the industries of the Timoto-Cuicas and indicates that there was extensive communication and trading among tribes of a large area.

In another monograph (2), he explains the process by which smoked tobacco could have been transformed to the licked type, of which chimó is an example. "Why was chimó found only in the Venezuelan Andes and possibly in their periphery? To answer that question, we remember the custom of chewing coca or *hayo* mixed with lime, in the Andean culture area. This trait was extended to the Venezuelan coast as an expansion of the Andean culture. In the case of chimó, we see a contrary movement: tobacco, characteristic of the lowlands, ascends to the mountain range, to the Timoto-Cuica area. But the phenomenon does not limit itself to the ascent but also the tobacco on being mixed with *urao* or other alkaline substance to obtain chimó, simply made use of the mixing system which was customary with coca or *hayo*. We are . . . in the presence of a coterminous

cultural complex: there descends from the Andes the habit of chewing coca mixed with an alkalizer; and there ascends from the lowlands tobacco which is no longer smoked, to chew with the addition of an alkaline substance as if it were coca. In Colonial times were added to this the receptacles in which the preparation is carried and the use of cowhorn in which to store the product. It is not impossible that in pre-Hispanic times, deerhorn receptacles were used. What is certain is that there is preserved today in the Andean states and in the western plains (Llanos) the old, pre-Hispanic complex, enriched by Colonial constituents."

Mason (43) also feels that, as with tobacco, the use and form of chimó resulted from contact with coca techniques. He comments that, in the western Amazon basin, tobacco is either licked or chewed: "This is doubtless due to the coca-chewing habit of the Andean highlands, many of these tobacco-licking tribes also chewing the coca leaf."[3]

The link between chimó and tobacco concentrate is a very close one, and it introduces a second theory concerning chimó in the Venezuelan Andes.

Tobacco concentrate (*ambíl*) is made and used by two widely separated groups of primitive Indians. One group is composed of tribes (notably the Witoto and Bora, but including the Jívaro, Campa and Piro) of the western Amazon basin. The other group (notably the Kogi or Cágaba, Ika and Sanká) is located in the Sierra Nevada de Santa Marta, in northeasternmost Colombia; their generic name is Arhuaco (20).

The method of making tobacco concentrate of these tribes is essentially that of making chimó, although the product may be either a thick liquid or a paste.

The utilization of tobacco concentrate among them

ranges from tribal ceremonial to interpersonal ceremonial to hedonic. In this range of use, it differs from chimó, which is employed purely for pleasure, except in a very few cases.

Accounts of making tobacco concentrate by the Kogi and their neighbors are neither numerous nor detailed.

Rosa (54), whose general description of the Arhuaco of the Sierra Nevada de Santa Marta is both early and extensive, refers to the cultivation of tobacco yet does not describe its use as a concentrate.

An early account by Brettes (13), who began to observe the Kogi (he calls them the Kaggaba) in 1891 and published his report in 1903, describes the use of tobacco concentrate but not its manufacture. In fact, he seems not to have known exactly what it was. Brettes calls the mutual use of tobacco concentrate "the greeting machine" and describes gourds with tops which contain "a sort of honey [or translation could be 'syrup'] mixed with nicotine, called *naoi* or *mouai*. . . . When two Indians meet they first tell each other all the news each gathered on his journey. . . . During the conversation the salute is made; it consists of this: (they first exchange a few coca leaves, putting them into each other's bag). X takes his container of honey and nicotine and gives it to Z. Z gives his to X. The two open the containers, rapidly put the end of a finger two or three times into the honey, put their fingers into their mouths, close the containers and return them."

That this "honey and nicotine" of Brettes is the tobacco concentrate under discussion is borne out by Mason's (43) description of the Arhuaco use of tobacco concentrate. In referring to the meeting and exchange of gourds, however, he says the tobacco mixture is only touched to the lips and that frequently the men simply go through the motions.

Brettes' "greeting machine" is a good example of interpersonal ceremonial use of tobacco.

Reichel-Dolmatoff (51), writing about 50 years later than Brettes, omits this usage in his description of salutations, mentioning only the exchange of coca leaves. He seems to refer, however, to meetings within the village, while Brettes suggests that a journey is involved; perhaps the full ceremony took place only in the special case of an absence of some duration.

The preparation of tobacco concentrate among the modern Kogi is described briefly by Reichel-Dolmatoff (51): "They cook tobacco leaves for hours and days until they obtain a concentrated thick juice. This they mix with a little yuca starch and *sagú* and keep it in a calabash container (*tami*) covered with a similar but larger one. With the fingernail they take out a small quantity of this paste and rub it on the teeth and gums when they chew coca."

Sagú is *Maranta arundinacea*, West Indian arrowroot. Uscátegui (63), describing this same process, uses the word *sugii* (*Sorghum* spp.). He also says that the liquid tobacco preparation is called *mó* or *chimó*.

Accounts of the preparation and use of tobacco concentrate in the western Amazon basin are complete and reflect first hand observation. Of many observers, Schultes (55) gives the most detailed account, adding botanical as well as ethnological information.

It will be noted that the preparation by the Kogi and the Witoto is essentially the same. Uscátegui (63) states that these two tribes, so far apart geographically, have some analogies in their myths. He speculates on possible remote connections between them but offers no answers. The Witoto, he points out, live today in several localities of Colombia and adjacent Peru. During the rubber

boom, they fled from virtual enslavement, and suffered much cultural disintegration. The Bora, a kindred tribe with many of the same customs, have preserved more of their indigenous culture.

In view of these circumstances, it is interesting to compare Whiffen's (68) account of the making of tobacco concentrate and its use as he observed it in 1908–1909, and other early reports, with that of Schultes.

Schultes (55) introduces his account of the making of tobacco concentrate among the Witoto of the Colombian Amazonia with a brief résumé of its use and that of coca by this tribe.

"It is applied to the tip of the tongue with a small stick. . . . It is usually kept in containers made of half the fruit of the wild *cacao* (*Theobroma glaucum* Karsten) . . . . Occasionally (this) *ambíl* can be kept in containers of glass or tin, but the Indians think that the wild *cacao* shell contains something sweet that improves the flavor of the *ambíl*. For this reason, it is preferred to any other kind of container. . . . There is a close connection between the use of tobacco and of coca among the Witoto . . . . As prepared by them and others, coca has a more or less salty taste and is pale green; it is always prepared as a powder. The toasted leaves of *Erythroxylon Coca* Lam. are pulverized in a hollowed log and the resultant powder is mixed with well-sifted ashes of the leaves of *yarumo* (*Cecropia peltata* L.) and with the ashes of other species of the same genus. A tablespoonful or more . . . of this mixture is taken at intervals during the day. It is true that at times coca is taken without tobacco and that *ambíl* is used at times by those who are not coca-chewers. However, usually a little *ambíl* is placed on the tip of the tongue just before taking coca."

Witoto women do not use coca, but some use *ambíl*, according to Schultes, even during pregnancy, when

there are many prohibitions—an interesting detail, since Whiffen reported that women were prohibited the use of tobacco in any form.

The preparation of *ambíl* is described by Schultes as follows: "The preparation of *ambíl* is interesting, because it shows another example of the use of alkaline ashes with a narcotic-alkaloid, a custom widely spread in many parts of the world. The Witoto cultivate *Nicotiana Tabacum* very carefully, sowing it in the plots of *yuca* (*Manihot esculenta* Crantz). Only the largest and greenest leaves of the lower part of the plant are selected for making *ambíl.* One or two basketfuls of leaves are placed in a clay vessel which is usually three-quarters full of water. This mixture is placed on a pile of firewood, where it boils for six or eight hours, sometimes more. The mouth of the vessel is covered with a large leaf to lessen evaporation. When the extract is thickening and the evaporation slows up, the fire is put out and the extract is allowed to cool. The residue of the tobacco leaves is removed by hand, and all the excess juice is squeezed out. Before the extract concentrates to make a thick syrup or in some cases a paste, the *ambíl* is taken out of the vessel and, while being carefully stirred, is mixed with alkaline salts.

"These salts are prepared by evaporating water which has been poured over and drained through the ashes of various plants commonly used for this purpose. A huge forest tree of the genus *Lecythis* . . . is probably the most used source of alkaline ashes. Among other plants which are used now and then in the preparation of these ashes are two palms: a *Bactris* and a *Chamaedorea.* The stem and leaves of the *Chamaedorea* . . . and the young shoots of the *Bactris* . . . are reduced to ashes.

"There are small variations in the method of preparing Witoto *ambíl.* In El Encanto, for example, during the boiling, two avocado (*Persea americana* Mill) seeds are

added to the tobacco leaves. . . . Some individuals add yuca starch . . . to the tobacco extract to give it a firmer consistency. Occasionally, crude sugar (*Saccharum officinarum* L.) . . . also is added to sweeten the mixture.

"The Witoto generally prepare the *ambíl* at night, two or three persons staying awake to tend the fire and stir the extract. Sometimes, however, the making of *ambíl* takes place during the day. There is no special day or time for the preparation of this narcotic. Moreover, no ceremony takes place during the preparation, and any man of the tribe can do it.

"*Ambíl* generally keeps for four or five months. After this time, if not used it is thrown out, and a new supply is made."

Schultes comments in conclusion that the Witoto assert that the Bora prepare and use *ambíl* as they do but have a ritual in connection with its preparation. He quotes Whiffen in some detail concerning ceremonial uses of *ambíl* (see note 4).

Comparison of Schultes' description of Witoto *ambíl*-making with that of mó and chimó shows that both process and product are strikingly similar, even to the detail of the use of *cernada* made from the ashes of certain preferred plants.

From the examples here given it is evident that there is a close connection between the tobacco concentrate of primitives and the chimó of non-Indian, civilized people.[4]

There remain the questions of how and when chimó appeared in the Venezuelan Andes.

As to "when": on the basis of present knowledge of the prehistory of this area, this cannot be answered with any certainty. It is known, however, that it arrived in pre-Columbian times and, by the time it was observed by early chroniclers, was a conspicuous culture trait of

Andean tribes of the Mérida, Trujillo and Táchira area.

The "how" admits of more than one theory. Two possibilities especially present themselves when pertinent circumstances are considered.

Chimó could have evolved through the contact of a lowland tobacco-use with the coca-complex, as described by Acosta Saignes. Or it could have resulted from a transmission of *ambíl* techniques, including this tobacco concentrate itself, to which it bears so close a likeness. This latter possibility involves first of all the question of tribal contacts. Aguado (3), describing trading in *urao* in the Venezuelan Andes, refers to extensive intertribal commerce preceding the Discovery. Acosta Saignes (1) lists commerce among prehistoric culture traits of the area, referring particularly to *urao* and cotton mantles as trade articles. That there were strong intertribal contacts throughout an extensive area of both Colombia and Venezuela (some substantiated by archaeological discoveries of common elements of culture) is stated in Métraux and Kirchhoff's (45) account of Colombian Indians.

The question of contact between tribes brings up another factor: ease or difficulty of access between groups.

The topography of northern Colombia and northwestern Venezuela comprises mountain ranges separated by river valleys. Some of these valleys provide a way to the sea, others to the lowlands of the Maracaibo basin.

The Venezuelan Andes are an extension of the Cordillera which runs the length of the Pacific coast of South America. This range bifurcates as it enters Venezuela, one branch to the east, the Sierra or Cordillera de Mérida. One continues north along the Venezuela-Colombian border, the Sierra de Perijá (which trends near the Sierra Nevada de Santa Marta).

The Sierra Nevada de Santa Marta is geographically and geologically distinct from the Andes, separated by

the Magdalena River in the south and the César River in the southeast. It has an area of some 5,000 square miles, and its axis runs approximately east-west, in contrast to the approximately north-south axis of the Andes (40, 47, 64).

The Kogi of the Sierra Nevada de Santa Marta occupy a lens-shaped territory, the long axis of which runs east-west, situated back from the sea coast to its north and west, with a band of civilization between them and the sea. Various groups of the Kogi are located in small settlements along rivers and on the slopes (13, 47, 51). There was a migration of Kogi about 1875 (51); this may explain, in part, discrepancies between early and more recent accounts of these Indians and their neighbors.

Considering this topography, it is not difficult to imagine the relative ease of communication in pre-Columbian times between the Sierra Nevada de Santa Marta and the Venezuelan Andes; the trend of the mountains and their valleys would offer easy access to men on foot. Even today, there are traces of ancient roads, some with paving, leading in many directions (13).

A final factor in a consideration of transmission of a culture trait is archaeological evidence.

Artifacts indicate that the Indians of Colombia may have been culturally more advanced than those of Venezuela (64). They would, therefore, have been more likely to take the initiative in establishing communication and introducing their culture traits.

Acosta Saignes (pers. comm.) points out the present scarcity of information on migrations, particularly of the Goajiro. In 1954, however, he explored a large shell mound in the Goajiro area which was peculiar in containing ceramic ware of high quality, similar to some found in Colombia by Reichel-Dolmatoff. This similarity

leads Reichel-Dolmatoff to believe that there were migrations towards Venezuela by way of the César River.

That northern Colombia is an important crossroads region is now accepted by authorities (42).

One proven transmission by way of northern Colombia is that of maize. From Middle America "according to current beliefs of experts on the 'intermediate area', it spread south and east, reaching western Venezuela by way of Colombia" (69). Wagner (64) found charred maize cobs—some with grains—in her Carache, Venezuela, excavations. These were identified by Mangelsdorf and Cutler as belonging to the races of Pollo, Huevito and/or other varieties of maize. Two specimens were "quite primitive and could be the wild ancestor of the modern race Pollo and obviously relate to those of Andean Colombia" (30).

If maize could be transmitted, why not tobacco, especially tobacco in a particular form?

Reichel-Dolmatoff (pers. comm.) says: "I am inclined to think [use of tobacco concentrate] is an old aboriginal trait and not a recent development, but I admit that I have no proof. . . . There can be no doubt that prehistoric contacts between the Sierra Nevada de Santa Marta and the Andean regions of Venezuela were fairly close . . . . The trait might have passed over the Sierra de Perijá and the Yuco Indians (who use coca) might have been the intermediaries."

In summary, it can be said that chimó appeared in the Venezuelan Andes at an early date and definitely was there in pre-Columbian times; and that it may have appeared from the lowlands (transformed by contact with the coca complex of the highlands) or have been transmitted from the Sierra Nevada de Santa Marta by tribes who made and used *ambíl*, a concentrate practically identical to chimó as known at present.

"How" and "when" are provocative questions, but the remarkable characteristic of chimó is the persistence of a primitive method of preparation and form over generations of use by individuals identified with modern civilization who are neither primitive nor Indian.

True, chimó has altered in actual use. It is used for personal pleasure, not ceremonially—unless one man's offering his chimó to another can be considered a remnant of interpersonal ceremony. For every *campesino* who buys a *bojote* wrapped in leaf, there are others who buy it in trademarked sticks. It is sold in modern shops as well as in markets or by the *chimoeros* themselves.

According to Valero (pers. comm.), whose interest in folklore may color his opinion, the younger people make little use of chimó, partly because of the availability of cigarettes and partly because anything "native" is scorned, whereas anything introduced is "smart". He adds, nevertheless, that there are still many rural people, young and old—including some cultivated people of both sexes—who use chimó in Venezuela.

Chimó and its counterpart, tobacco concentrate, are known to have been employed at least for about 500 years. Dupouy (27), writing in the early 1950's, states that the use of chimó has spread widely from the lands of Venezuela's Timoto-Cuicas, the area of its apparent origin.

Chimó could be disappearing gradually in the general population to persist in specialized groups alone, much as the use of snuff and chewing tobacco has waned. Whatever the case, this unusual form of tobacco has had one of the longest and most interesting histories in human utilization of *Nicotiana Tabacum*.

Notes—Part I

1. *Licking.* Ramón y Rivera, authority on Venezuelan folklore, questions the word "licking". He says (pers. comm.), "In any case it is not 'licking' but 'teething'—*chupado* (sucked)—since to lick anything the tongue is protruded, and this is not done."

At the risk of seeming to quibble, I cite a dictionary definition: "lick—pass the tongue over" (Webster's New World Dict., College Ed., 1964). According to this definition the tongue need not be protruded. I simulated the use of chimó by applying a pea-sized bit of soft caramel to the inner surface of the lower teeth. In my experience, the tongue continually passes over the dissolving material and thus may be said to "lick" it. By contrast, in snuff-dipping, the powdered tobacco is placed in the mouth between gum and cheek, where it is sucked, not licked or chewed (34).

2. *Alkalizing agents. Nicotiana Tabacum* contains the alkaloid nicotine. Unlike some other alkaloids, nicotine does not require an alkalizer to free it. Laboratory tests, however, show that the presence of an alkalizing agent accelerates and intensifies the action of the alkaloid on the human organism (32).

Lewin (41) reports: "We are here once more confronted with the remarkable practice of adding alkaline substances to stimulating or narcotic remedies. . . this is done in the case of. . . coca and betel and also in that of tobacco. Peoples of all kinds have instinctively found the most suitable means of setting free the active elements of the plant and enabling them to pass into the organism."

With chimó, the alkalizing agents used are water in which plant ash has been soaked to make lye (*cernada*), *urao* (sesquicarbonate of soda) and bicarbonate of soda.

The use of ash from plant material is a common addition to tobacco. Lewin cites several instances in the Old World, especially in the case of snuff and chewing tobacco. Plant ash is also a New World additive to tobacco and other narcotic substances (55, 63).

3. *Urao. Urao* (also *jurao*, *hurao*, *xurao*, sesquicarbonate of soda, the trona of Africa) is found in the bed of a lagoon at Lagunillas, near the city of Mérida, Táchira State. It has been in use—not exclusively with chimó—since pre-Columbian times and is reported to be nearly exhausted (1; Venez. Minis. de Fomento, pers. comm.).

The *urao*—a grayish or yellow-gray, water-soluble, alkaline-tasting substance, occurs in lenticular layer formation of varying thickness.

A white deposit of unknown composition and the mineral gaylussite cover the *urao* (9).

Codazzi (19), writing of Venezuela in the 19th Century, says the Indians remove the *urao* by diving four or five fathoms deep. Métraux and Kirchoff (45) give details of use at the time of the Conquest: "The Indians living at Lake Jurao in the Venezuelan Andes cut through two layers of deposits in the lake bottom to obtain chunks of sodium carbonate (*jurao*). They used it as a salt substitute on food, they mixed it with coca (?) in place of lime, and they made it into a paste which they licked." They add that these Indians traded *urao* to many other tribes.

A lively and interesting account of *urao* at the time of the Conquest is that of Fray Pedro de Aguado (3), who wrote in the 16th Century, part of which follows: ". . . these Indians are superior and respected by the other Indians of this province. . . because of a certain lake or lagoon that (they) have in their land in which. . . there coagulates in the bed and bottom of it a kind of very bitter. . . saltpeter, that is neither salt nor saltpeter, which would not serve us for either; and of this kind of saltpeter the whole floor of the lagoon is made, or most of it, a crust which in part is very thick and in part thin, from which the Indians break off and take away to sell to all who come to buy . . . . Actually, the Indians want this saltpeter principally to eat, though it is eaten in various ways; some eat it with *echayo* [*hayo* or coca meant here, possibly] instead of lime, and others eat it with other food instead of salt, and others make a kind of paste (*betún*) of it like mead (sic) and this they eat by licking and giving evidence of enjoying it a great deal, and thus they are all vassals and contribute to those who have the lagoon and take out this saltpeter, which in their language they call *xurao*, and it is the principal money between these Indians I have described, because with it (they) give and sell all they have and are solicited (for). Also the Spanish make use of this saltpeter to give it to their horses, which purges and fattens them a great deal."

I have quoted this account at length because from it several significant inferences may be drawn. First: *urao* was known and used among a great number of Indians and was employed in several ways. One possibly was with coca. Granted the supposition is valid that tobacco borrowed details of preparation and use from coca, it may be supposed as well that *urao* was also utilized in chimó, although Aguado does not mention it. On the other hand, if chimó borrowed from tobacco concentrate in its preparation, plant ash would more probably be the alkalizer used, though use of *urao* would not be ruled out. Second: *urao* was made into a paste, probably resembling chimó in form and was licked. This closely parallels chimó use and could have

influenced the evolution of chimó from a semi-liquid to a paste.

Acosta Saignes (1) in his account of the Timoto-Cuica civilization, says that these people took chimó and that they employed *urao* in its preparation.

There is a generally accepted version of how *urao* and chimó were first associated, which contradicts Acosta Saignes' statement. Díaz (24) is one of several writers who advance this theory: "Although the indigenes used mó and chimó before the Conquest, they did not mix it with *urao* until 1781, when the Spanish chemist Pedro Verástegui showed them how to make it with this; for which reason, when the Spanish established the monopoly (*estanco*) on tobacco, the *urao* was also included in the monopoly."

Patiño (48) comments in one of the very few descriptions of chimó that I have been able to find: although Verástegui is given credit for first introducing the use of *urao* in the making of chimó, "from the very instructions left by him, it can be deduced that mohoo or chimó or call it what you will, was something known and common—implying that he only emphasized details of a procedure already followed."

The use of *urao* is at present an integral part of descriptions of chimó. *Urao*, reduced to powder, is added to chimó in varying quantities, as an alternative to the use of *cernada*. Chimó-users assert that it results in a "smoother" product with a salty taste. Chimó made in Mérida is cited as an example of this type of chimó. Bicarbonate of soda is sometimes substituted for *urao* and is added in the same way.

4. *Types of chimó.* Dupouy (27) describes chimó of various types. If it is strong and biting, it is *bravo* or fierce; if mellow, it is *manso* or tame. The latter is *dulce* or sweet and is less irritating and less toxic than the *bravo*, because it contains more mellowing ingredients. Only the most habitual users (*buenos comedores*) use chimó of the most *bravo* type.

The toxic effect of chimó is very marked on individuals not accustomed to the narcotic.

In a laboratory experiment with chimó at Harvard University in 1968, a graduate student, a non-smoker, placed an amount of chimó "the size of an eraser on a new pencil" on the back of his lower front teeth. He reports: "At first, it was cold and tarry like licorice. When it warmed up, I began to feel a biting sensation. . . prickly instead of hot like chili pepper. The sensation increased. . . until an area about the size of a penny on the under side of my tongue became numb. At the same time, I began to feel light-headed, as though I had taken several strong drinks on an empty stomach or had inhaled several puffs from a strong cigar. That effect lasted for about 15 minutes, after which my sense of balance and presence of mind returned to normal. During that time, I felt slightly unstable while

walking. After the major effect of light-headedness, I began to feel as though I were near to vomiting. That lasted for about an hour.''

A widely valued antidote for the toxic effects of nicotine is any strong alcoholic drink. In Venezuela, the one usually recommended is a wine glass of *cocui* (or *cocuy:* a liquor made locally from *Agave Cocui,* similar to the *mezcal* of Mexico) (27).

5. *Sarrapia; curía. Sarrapia* is tonka bean (*Dipteryx odorata*). It imparts a flavor similar to that of vanilla. The beans may be toasted before powdered for adding to chimó; the powder is sometimes incorporated into a little *cocui* and then added.

Curía is identified by Pittier (50) as *caría*. (*Justicia caracasana*); Alvarado (5) uses *curía*, *Rhytiglossa caracasana*, synonym of the former binomial. Another synonym occasionally found is *Ecbolium caracasana*.

This member of the Acanthaceae is described by Díaz (24) as an aromatic: ''The main use we make of *curía* is to flavor tobacco, placing the dry leaves in the boxes where it is stored or exported. . . . The aroma of this plant is not pronounced until it is quite dry.'' Alvarado defines *curía* as ''a herb, the leaves of which when crushed give off a balsamic odor reminiscent of that of *sarrapia*. In the chimó-making industry they have the custom of adding to the paste being prepared, an infusion of this herb.'' Valero (pers. comm.) indicates that *curía* spreads over the ground and has a pleasant odor; stating that it is not extensively used in chimó in the state of Trujillo but that some people put a leaf into their chimó boxes ''to give the chimó more taste''.

Although Venezuelan authorities specify that *J. caracasana* is the species utilized in the preparation of chimó, there is reason to assume that *J. pectoralis* may likewise be employed.

Mr. Dieter C. Wasshausen of the Smithsonian Institution informs me that *J. caracasana* is an endemic of the Caracas area whereas *J. pectoralis* is a common species found in the Caribbean area and northern South America growing in woods and wastelands and also in cultivated fields, adding that the name *curía* refers also to *J. pectoralis* in Venezuela (herbarium specimen, *Steyermark 61051*, USNH). *J. pectoralis* is, furthermore, known as *curía* in Colombia (54), Puerto Rico, and Panama.

The natives say they add *Justicia* to chimó simply because it has a pleasant aroma. It may be significant to note, however, that, in discussing the myristicaceous snuffs of the northwest Amazon, Schultes and Holmstedt (58) report the occasional addition of *J. pectoralis* var. *stenophylla* to snuff made of *Virola* resin, stating: ''There are preliminary indications that *J. pectoralis* var. *stenophylla* may possess alkaloidal principles''.

The addition of the *Justicia*, consequently, might play a physiological role in the effects of the snuff.

6. *Chimú*. Chimó is known as chimú in Colombia. Reichel-Dolmatoff (pers. comm.) states: "Chimó—or chimú as it is called in Colombia—is widely used by the peasants and lower urban classes of the Department of Santandér del Norte". Ramón y Rivera (pers. comm.) asserts that "no author points out and I say it now, that in the Venezuelan Andes they say 'chimú', not 'chimó'; this latter form is more correct". I did not hear "chimú"; but I did not speak with cultivated persons in the Andes. Valero (pers. comm.) insists that only "chimó" is used in Venezuela.

7. *En Istú*. In this sense, this expression does not appear in any of several dictionaries consulted. Informants gave it also as *indistú* and *en istú*. In a letter from the Ministerio de Fomento the word was written with a capital "I" and a later letter confirmed the correctness of this form.

According to Valero and Rojas (pers. comms.) "*istú*" is an indigenous word and the name of a wild medicinal plant of the Andes which is cooked and eaten as food. Acosta Saignes (1) lists *istú* as a plant cultivated by Venezuela's aboriginal Indians for food, from which also, paint was made. Alvarado (5) says the "*istú*" of Trujillo furnishes an indelible black dye and that its fruit, boiled in soup, gives a flavor of meat. He quotes Ernst in giving it an identity also as "*conopio*". Pittier (50) lists *conopio* as the zingiberaceous *Renealmia occidentalis*.

There seems to be no connection between this word used for "crude chimó" and the name of a plant—unless it be the very tenuous association of the blackness of the crude chimó and the black dye of the *istú* plant.

8. *Cernada*. The word "*cernada*" is employed for a solid cake of ash and also for the liquid resulting from the soaking or leaching of this ash. The ash results from the burning of plant material and the liquid is caustic potash or lye (*lejía*). It ordinarily contains an average of 25% to 30% of lime and 0.5% potash and is strongly alkaline.

In Venezuela, several types of plant material reduced to ashes are used to make *cernada*. The following according to Valero (pers. comm.) are preferred: 1) The wood of *bucare* (*Erythrina* spp.), planted to shade coffee trees, likewise known as *anauco*, *ceibo*, *immortelle*.

2) The rinds of fruit or the stem sheath of plantain or banana. Valero (pers. comm.) comments that the collecting and burning of these is customarily done by elderly country women. They add a little water to ash and form it into a cake, or they add water and evaporate it until a solid mass is left. This cake or mass, wrapped in the dried sheath of the banana or plantain stem, is sold to the *chimoeros*.

This banana association is especially interesting, since it is charac-

teristic of the preparation of tobacco for utilization in other forms than chimó. Lewin (41) cites Liberian tribes who use the ash of banana skins to make chewing tobacco, and both Calella (16) and Uscátegui (63) mention this same use by the Siona of the Amazon basin, in their preparation of tobacco concentrate (*ambíl*).

3) Bean chaff (*tamo de caraota—Leguminosae* spp.). This, the waste after semi-dried beans are flailed and winnowed, consists of stems, leaves and pods. It is considered especially good for making *cernada*, according to Valero (pers. comm.).

Before the water in which the ash has soaked is added to the mó, it is strained through a cloth, so that no solid material remains in the chimó. To a given quantity of mó, about one fourth the quantity of *cernada* is added, for chimó of average strength (Valero pers. comm.). Depending on the amount of *cernada* added, chimó is more or less strong (*bravo*).

9. *Additives.* As has been noted, the question of what is added to chimó and when, involves conflicting statements. Among informants with first hand knowledge, additives are mentioned vaguely, if at all. Sundry writers give a variety of substances as additives. The following list is drawn from several accounts:

Anise (*anís, Pimpinella Anisum*); *chivata* or *cervata*, a plant that I am unable to identify, mentioned by Valero (pers. comm.) who states that it is not often used because it softens (*aflojar*) the chimó too much; cloves (*clavo de olor, Eugenia caryophyllata*); *cocui* (or *cocuy*, liquor from *Agave Cocui*); *curia* (see above); nutmeg (*nuez moscada, Myristica fragrans*); tonka bean (*sarrapia, Dipteryx odorata*); vanilla (*vainilla, Vanilla planifolia*).

For sweetening, crude, brown sugar is added. Made from sugar cane (*Saccharum officinarum*), it is called *panela* or *papelón* in Venezuela, depending on whether it is brick or cone shaped.

Under additives, two more items present special problems.

Lewin (41), giving no source, states that opium is "occasionally added" to chimó. The only other mention of opium in connection with Venezuelan tobacco is in Billings (10) who, referring to tobacco, not chimó, asserts: "For their own use they have adopted the method of the Brazilians, sprinkling the leaf with water containing the juice of the poppy." In his description of Brazilian tobacco, however, he makes no mention of "the juice of the poppy". I did not find any mention of opium or paregoric in several accounts of Venezuelan tobacco production (e.g. 19, 24, 29, 48), nor has Valero ever heard of the practice.

Also presenting a special problem is the use of the leaves of *Palicourea Chimó* and those of at least two other rubiaceous species. Steyermark (62) quotes from his published description: "The specific name

'chimó' refers to the use of this and other similar species by the local inhabitants with reference to the leaves' being boiled with those of the tobacco plant to make tobacco juice, known in this area as 'chimó'''. Steyermark's collection gives the local name of *Palicourea Chimó* as ''*cafecito blanco*''. Of the other similar species he mentions two: *Guettarda sabiceoides* (''*quina negra*'') and *Cephaelis tinctoria* (''*cafecito*''). All three of these were collected in the State of Lara near Humocaro Bajo, and Steyermark's information came from people of that region. He is careful to add (pers. comm.), ''whatever else takes place before or after this (the boiling), I do not have any data as to other steps in the process. I actually did not watch the operation but was merely told about it, and of course second hand information is never to be trusted''.

Assuming that his informants were correct in their identification and names, the question of whether these names and the use of the plants are widespread or are restricted to this area, still remains; that is, whether this use is or is not a significant factor in the making of chimó. It would be helpful also, to know why these leaves are added to the tobacco leaves.

Recent studies of rubiaceous species indicate that the family does contain psychoactive substances. Schultes (57) cites the use in caapi of *Psychotria* by the Kofán Indians of Amazonian Ecuador. Der Marderosian et al. (23) describe the use of *Psychotria* spp. in a beverage, by the Cashinahua of the Amazon basin, and states that the psychotomimetic DMT has been found in the leaves of *Psychotria* spp. and isolated in crystal form from the beverage. This is the first reported occurrence of DMT in the *Rubiaceae*.

Could chimó with the addition of rubiaceous plants, reported by Steyermark, possibly have different effects than chimó made only of tobacco?

Steyermark's report is the more interesting because it is the only such information uncovered in my study of the preparation and use of chimó and of tobacco concentrates in general. Accounts of the making of mó all emphasize that only tobacco leaves are employed and in lists of additives used during the second step—the conversion of mó to chimó—the common names of these rubiaceous plants do not appear. Confirmation of Steyermark's reports and critical confirmation of the common names involved, and why the additives are used—these points need clarification.

10. *Spitting*. Díaz (24) writes: ''This vice is the dirtiest of tobacco use, the more so for the saliva, more abundant, blacker and greasy, that it produces''. Whenever the general use of chimó is described, the necessity of frequent expectoration (without a receptacle) is men-

tioned. On the other hand, references to chimó among the upper class omit reference to this need.

The statement of a lady (pers. comm.) who remembered her Andean grandmother's use of chimó, is enlightening. Her grandmother kept near her one of a set of small crystal bowls, which was replaced each time she used it.

Jahn (37) illustrates an account of snuff with a representation of a Restoration dandy with what is described as a "spitting basin" in one hand, a snuff box in the other. Such omission of unpleasant details is also characteristic of descriptions of snuff-dipping. The account of Virginia belles' dipping snuff quoted in the text, is a good example of this silence on the subject.

Contrasted with these are accounts of and stories about tobacco chewing, a custom identified with "the common man" and with virility and masculinity, in which expectoration is freely referred to and is even the subject of anecdotes and jokes.

11. *Placing chimó behind the teeth.* Valero (pers. comm.) makes a qualifying comment, since so many country folk lose teeth early: "Those who lack front teeth," he says, "place it behind the gums".

12. *Cajetas.* Probably the truth about chimó boxes other than the commonly used round ones, lies somewhere between Pinedo's statement and my own experience. Valero's description of what evidently seemed to him a common variant is borne out by the fact that I acquired a number of fancifully shaped *cajetas* in Boconó—a town far removed from tourist influence or a market for collectors.

When they were brought to me to be examined and admired, I had the impression that here were boxes designed for use and were simply more interesting than round boxes. They cost two or three times as much as the round ones; but they had much more detail than the plain ones, the *cajetas corrientes*.

Among my *cajetas* there is a very small turtle with red spots on his back, picked up in a Caracas pawnshop. The inside of this box is dark with the remains of chimó. Unused boxes in my collection include one with *paletica* made of horn to match the box, attached by a silver chain to a silver medallion in the center of the top of the box.

Some snuff boxes in museum collections are accompanied by tiny spoons or shovels; and chimó boxes made of horn tips find a counterpart in snuff boxes. Stern, in his *Sentimental Journey*, for example, describes a snuff box shaped like a cornucopia with a lid—surely not the only one in existence in his time.

13. *San Benito.* There are two other verses referring to the saint's black teeth:

San Benito tiene sus dientes negros/De puro comer chimó aliña'o/
Bebe aguardiente en los eneros/Y por eso lo vemos rasca'o.
Saint Benedict has black teeth/From eating flavored chimó/
He drinks *aguardiente* in January (his feast-time)/
And so we see him drunk.
San Benito viene de Boconó/Muy feliz se siente/Tiene sus dientes negros de puro comer chimó/Viene a bailar con toda la gente.
Saint Benedict comes from Boconó/He feels very happy/He has black teeth just from eating chimó/He comes to dance with everybody.

These and other verses of Andean origin (Valero, pers. comm.), indicate how admirable it is to have black teeth from eating chimó: perhaps there is the implication that a man who can buy enough chimó to discolor his teeth is to be respected. (See betel and black teeth, below.)

14. *Black teeth.* Many observers of the use of tobacco, coca and betel have commented on dark-stained or black teeth of users. Whether they are discolored or really black, is not certain from the descriptions of these observers.

Patiño (48) quotes Las Casas (18) on Indians chewing coca, "... that having the teeth very white commonly, a crust is put on them blacker than jet (*azabache*)."

Humboldt (36), in describing the Goajiro use of lime alone as a stimulant, states that lime blackens teeth. Métraux and Kirchoff (45) report that these Indians formerly chewed coca with lime, thus blackening the teeth. Reichel-Dolmatoff (51), on the other hand, states of the Kogi: "The blackened teeth which many men have do not result from coca but from the consumption of this concentrated paste (of tobacco)." Schultes (55) observes that the Witoto have discolored teeth and that their coca is mixed with ashes, not lime; they also use tobacco concentrate. "The constant use of these two narcotics," he reports, "affects perceptibly the sense of taste and discolors the teeth." As these representative samplings of opinion indicate, both lime and tobacco are suggested as causes of black or stained teeth.

In addition there remains the question of "black" versus "dark-stained". With the Witoto and Kogi, where tobacco as well as coca is used, dark-staining seems to be the result. Perhaps, as Valero says of chimó users, this is due simply to lack of cleaning the teeth. Alternatively, lime or lime and coca seem to be responsible for a kind of black crust—a really black tooth.

Perhaps a short account of the use of betel will throw light on the question of blackening of the teeth.

Lewin (41) describes the typical betel morsel as composed basically of areca nut, a betel leaf and burnt lime about the size of a pea. "In inveterate betel-chewers who do not keep themselves very clean," he says, "a crust, mainly consisting of calcium carbonate, is formed in the course of time on the teeth and gums. In the Admiralty Islands, the formation of this 'tooth-stone' is regarded as an attribute of the dignity of chief, for only the very rich are in a position to indulge so freely in chewing as to produce such quantities of 'tooth-stone'. When the mouth is closed, these dental excrescences protrude from between the lips like the point of a black tongue."

Considering the proportion of lime in betel and its apparent result, it may be useful to note that the plant ash used in the Witoto and Kogi tobacco concentrate contains lime—but obviously not in the amount found in betel and coca preparations.

Perhaps these generalities are justified: Tobacco seems to be responsible for stained teeth, while lime seems to form a black crust. In both cases, lack of cleanliness is a secondary factor. Furthermore, in the case of chimó and betel, black or dark teeth may be a source of prestige.

There are many instances of deliberate tooth-blackening among primitive peoples. Whiffen (68) cites the case of Issa women of the Amazon who cover their teeth and fingernails with black pigment. Humboldt (36) describes the Chaymas of northern Venezuela who blacken the teeth "from the age of fifteen by the juices of certain herbs and caustic lime". He states that the leaves of a tree resembling the myrtle are used and that the presence of lime is significant.

Various reasons for tooth-blackening are given by those who practice the custom: e.g. that it protects the teeth and prevents toothache, but most investigators regard these as excuses or evasions. Humboldt (36) writes: "I doubt much whether the custom. . . was originally suggested, as Gomara supposed, by absurd notions of beauty, or was practiced with the view of preventing the toothache".

In all probability, tooth-blackening originally had a religious and ceremonial context which became secularized and non-ceremonial as traditional customs were altered by tribal contacts with Europeans.

15. "*Tabaco en la vejiga.*" This phrase means literally "tobacco in the bladder", referring to the bladder of a bull, used as a pouch for chewing tobacco by the cowboys of the Venezuelan plains (*llaneros*). Mendoza (44) equates the possession of such a pouch full of chewing tobacco with a man's characteristics of courage, vigor and virility. The expression is used all over Venezuela in this sense.

Notes—Part II

1. *Uses and names for tobacco among primitives.* Tobacco plays many roles in primitive societies (21): 1) curative of certain diseases and wounds and defense against insects and pests; 2) preventive of hunger, thirst, fatigue and restorative of physical and mental energy; 3) ceremonial; 4) medium of exchange; 5) source of pleasure to taste and smell and as a narcotic or stimulant in a variety of methods of consumption.

Synonyms for tobacco are many; among them are: Brazil, *petum* or *petun;* Peru, *sayre;* Colombia, *yuri;* Aztec Mexico, *picietl*, *yietl* (34). Sundry Indian tribes have their own names for tobacco (48). The Spanish word is *tabaco.*

2. *Contexts of use.* La Barre (40) points out that the significant distinguishing factor between aboriginal and present uses is that the former had a sacred context. Since it altered the psychic state, tobacco was believed to possess supernatural power.

Some authorities explain its passing into hedonic use today by the fact that, as primitive groups were exposed to civilized customs, their own cultures deteriorated. In their resultant insecurity and despair, these groups turned to a generalized use of tobacco and other narcotics for comfort and reassurance.

3. *Coca and chimó parallels.* With both coca and chimó, a plant substance containing a narcotic, together with an alkalizing agent, is put into the mouth and kept there where its active constituents are absorbed through the mucous membrane. With coca, where saliva is usually swallowed, the stomach is also involved.

Users of both coca and chimó claim the same effects: prevention of hunger and fatigue and soothing of body and spirit. The Kogi alone deny to investigators that they use coca to banish hunger; these people assert that they take coca because it is pleasant and prevents sleepiness, so that they can talk all night with the Old Time Ones (*Los Antiguos*). They scorn any admission of hunger (51).

Both coca and chimó are used at frequent intervals, the user carrying them on his person in special containers.

Frequently, coca and tobacco concentrate are taken simultaneously. The Cágaba (Kogi) rub tobacco concentrate on their teeth and gums while chewing coca which, they say, tastes better (47, 51, 63). The Witoto place a little *ambíl* on the tip of the tongue, just before taking coca, according to Schultes (55), who adds that coca alone is

"more or less salty, tending to sweet" and the flavor of *ambíl* is "strong, piquant and salty"; when they are mixed, the taste is "very pleasant, warm, salty and slightly aromatic".

It is significant that whereas in the Andes coca leaves are used toasted and crushed and mixed in the mouth with lime, the coca of the Amazon basin is pulverized after toasting and mixed with plant ash before use. Since plant ash is used in the making of both tobacco concentrate and chimó, here is an additional factor bringing the two into a close relationship.

4. *Tobacco concentrate and chimó parallels.* Whiffen (68) and others describe the preparation and use of tobacco concentrate much as does Schultes. A comparison of these descriptions indicates that although details vary, the primitive process of making tobacco concentrate is essentially that of making chimó in modern Venezuela.

Whiffen, who studied the Witoto, Bora and other tribes in the Colombian Amazon in 1908–1909, describes the making of *ambil* briefly. Leaves of tobacco are soaked in water, then pounded in a mortar; a little thickened cassava starch is added, and the mixture is "a stiff, dark liquid" to be used either individually or ceremonially.

This procedure is also given by Cooper (20) who asserts that tobacco leaves may be soaked, pounded and mixed with cassava starch instead of being cooked, adding that, "a somewhat similar paste with the addition of other ingredients, is in use as pellets in contemporary Venezuela".

A similar way of making tobacco concentrate is reported by Driver (26) for the Indians of California and Nevada who, in the past, ground tobacco leaves in a stone mortar with lime and water and licked the concoction off the pestle.

Whiffen explains ceremonial uses of tobacco concentrate in detail: "The Indian parliament, the Indian court of law, is the 'tobacco palaver'. When word has gone round that it is desired to hold a council, the warriors and elders of the tribe foregather, and squat on their haunches around the tobacco-pot which. . . is placed in their midst . . . . When his final word is uttered, the spokesman will reach forward and take the pot, dip in a short stick, and wipe some of the black liquid on his tongue. He will then pass the pot around. . . and every man who has agreed with him will take tobacco. . . . The passing of tobacco is also used as a binding promise on every verbal agreement between individuals. In this case they will dip a small stick like a match into the liquid and pass it over the tongue, or put their forefingers into each others' tobacco-pots, made from the hollowed husks of nuts and which are usually carried suspended round the neck by a string. The tobacco-pot comes into requisition again at a friendly meeting, and serves to emphasize the binding nature of this friend-

ship''. Whiffen adds that formerly, births, weddings and other similar occasions were celebrated with gifts of *ambíl* and coca, and he refers to the importance of *ambíl* in Witoto mythology.

Monconill (46) describes the preparation of *ambíl* by the Witoto, stating that for thickening either *yuca* or the liquid containing tapioca, which results when *yuca* is squeezed to make *cazabe*, is used; the product is hard when cool. He writes that when the Indians have a meeting ''they place in the center of the group a small vessel containing a little cold water and a little ash from the cooking fire. . . and with the fingers they dissolve a ball of tobacco. They go on talking and in sign of assent. . . put a finger in and lick it; others put more than one finger in, or a small stick, etc. . . . They continue chewing coca. . . licking their fingers smeared with tobacco from time to time to signify applause. . . . Thus at times they pass the night.''

Callela (16) describes *ambíl* among the Siona, a tribe which ''cooks the leaf and cools the mixture. The leaves are removed, pounded and put into the liquid again. This continues to evaporate. More water is added until the mixture is very thick. When it is thick, they add husks of *cacao colorado de monte* (*Herrania* sp., probably *H. breviligulata*), burned to ash and sifted, also peel of green plantain, also reduced to ash, and the bark of *yoco* (*Paullinia Yoco*). All this they mix with the tobacco. They put it into a gourd (*puro*), and from this they take it. Some only lick it; others, more daring, swallow it. It is very strong. It causes dizziness in those not accustomed to it.''

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LATUA PUBIFLORA
MAGIC PLANT FROM SOUTHERN CHILE

BY

TIMOTHY PLOWMAN,[1] LARS OLOF GYLLENHAAL[2]
AND JAN ERIK LINDGREN[2]

INTRODUCTION

The Solanaceae or Nightshade Family has long been known for its narcotic, poisonous and medicinal plants, as well as for several important food plants. Various genera, such as *Datura*, *Mandragora*, *Atropa*, and *Hyoscyamus*, contain potent alkaloids which have physiological effects on man. Native peoples throughout the world have discovered these plants and their properties quite independently of one another. For example, in both the Old and New Worlds, different species of the genus *Datura* have been widely used as narcotics and poisons by peoples as different as the Hindus, ancient Greeks and American Indians.

This cultural convergence has occurred not only in the kinds of plants used but also in the circumstances and purposes involved in their use. Many solanaceous species contain the so-called belladonna alkaloids, including hyoscyamine and scopolamine. These substances have a marked effect on the central nervous system, producing delirium, hallucinations and trance-like states often re-

[1] Botanical Museum, Harvard University, Cambridge, Mass.
[2] Karolinska Institutet, Stockholm, Sweden.

sembling psychosis. Consequently, solanaceous drugs have been widely employed in native cultures for witchcraft and shamanism. Medicine men consider these plants valuable agents for communicating with the spirit world in order to diagnose the cause of illness. As in the case of other hallucinogenic plants, these species have definite therapeutic value and have long been administered for strictly medicinal purposes in diverse parts of the world.

One of the rarest and most interesting genera of the Solanaceae with these striking narcotic and toxic properties is *Latua*, an endemic from southern Chile with a single species: *L. pubiflora*. Owing to its great beauty and toxicity, *Latua* evoked some interest among botanists and pharmacologists shortly after its discovery in the middle of the 19th Century—an interest which led to a number of articles on the characteristics and effects of the plant. Yet, *Latua* still remains relatively unknown for two reasons. First: the plant grows only in the narrow coastal cordillera between Valdivia and Chiloé, a difficult mountainous terrain with an extremely wet climate and few roads; during the rainy season, the existing roads are nearly impassable. Second: the occurrence of *Latua* and its use is a closely guarded secret surrounded by much superstition, since the plant is employed primarily by local shamans and sorcerers in their magical healing rites. Those familiar with *Latua* and its properties are very protective of this knowledge and are unwilling to discuss it with outsiders. For this reason, little has appeared in the literature concerning the ethnotoxicity of *Latua*. We hope to summarize present knowledge of this plant and to add the results of our own chemical, botanical and anthropological research.

Latua pubiflora (*Griseb.*) *Baillon*, Hist. Plant. 9 (1888) 334.

Lycioplesium pubiflorum Grisebach, Syst. Bemerk. (1854) 40.

Latua venenosa R.A. Philippi in Bot. Zeit. 33 (1858) 24.

Shrub to small tree 2–10 m. tall, with one to several main trunks 3–25 cm. in diameter, spreading upward and outward from base. Bark thin, streaked with corky, longitudinal fissures, becoming somewhat rough, reddish to greyish brown. Branches smooth, grey, armed with spines. Branchlets cylindrical, those of current year's growth covered with yellowish brown pubescence, glabrescent. Spines erect, arising as modified branches in leaf axils, rigid, up to 2 cm. long, usually with a small leaf at the base and one or two minute cataphylls towards the apex. Leaves alternate, fascicled on short shoots or scattered on long shoots, simple, narrow-elliptic to oblong-lanceolate, apically acuminate, marginally entire to erose-serrate, basally attenuate, 3.5–12 cm. long, 1.5–4 cm. wide, pilose, glabrescent, dark to light green above, paler green beneath; petiole usually short, 2 mm. long, pilose, glabrescent. Stipules absent. Peduncle solitary, arising in the axil of a spine and its basal leaf, erect, 1-flowered, 5–9(20) mm. long, tomentose, with a series of overlapping bud scales at the base; scales ciliate, ovate, about 2 mm. long. Calyx inferior, gamosepalous, 5-parted, campanulate, persistent, somewhat accrescent, 8–10 mm. long, rugulose with tomentose pubescence, pale green to purplish, lobes valvate, acute, triangular, erect, about 3 mm. long; calyx in fruit 11–16 mm. long, splitting irregularly. Corolla much larger than calyx, gamopetalous, 5-parted, regular, elongate-urceolate, inflated, 3.5–4 cm. long, 1.5 cm. in diameter at the middle, densely pilose without, variably colored magenta to red-violet, lobes short, trilobate, recurved, about 5 mm. long with induplicate-valvate aestivation. Stamens 5,

inserted at base of corolla; filaments of different lengths, slightly exceeding corolla, filiform, 3–4 cm. long, adnate for 8 mm., basally pilose, glabrous above, bright pink; anthers bilocular, elliptic, longitudinally dehiscent, 2 mm. long, brownish; pollen ash grey, tricolporate. Ovary ovoid, basally gibbous, bilocular, with numerous anatropous ovules attached on axile placenta; style filiform, equalling corolla, 3 cm. long, pink; stigma short, semicircular, slightly bilobulate, bright green. Fruit a fleshy berry, globose, 2 cm. in diameter, apiculate, pale green to yellow. Seeds numerous, somewhat reniform or irregular, often flattened ventrally, 2 mm. in diameter, albuminous; testa thick, reticulate-pitted, dark brown to black. Embryo cylindrical, slightly curved.

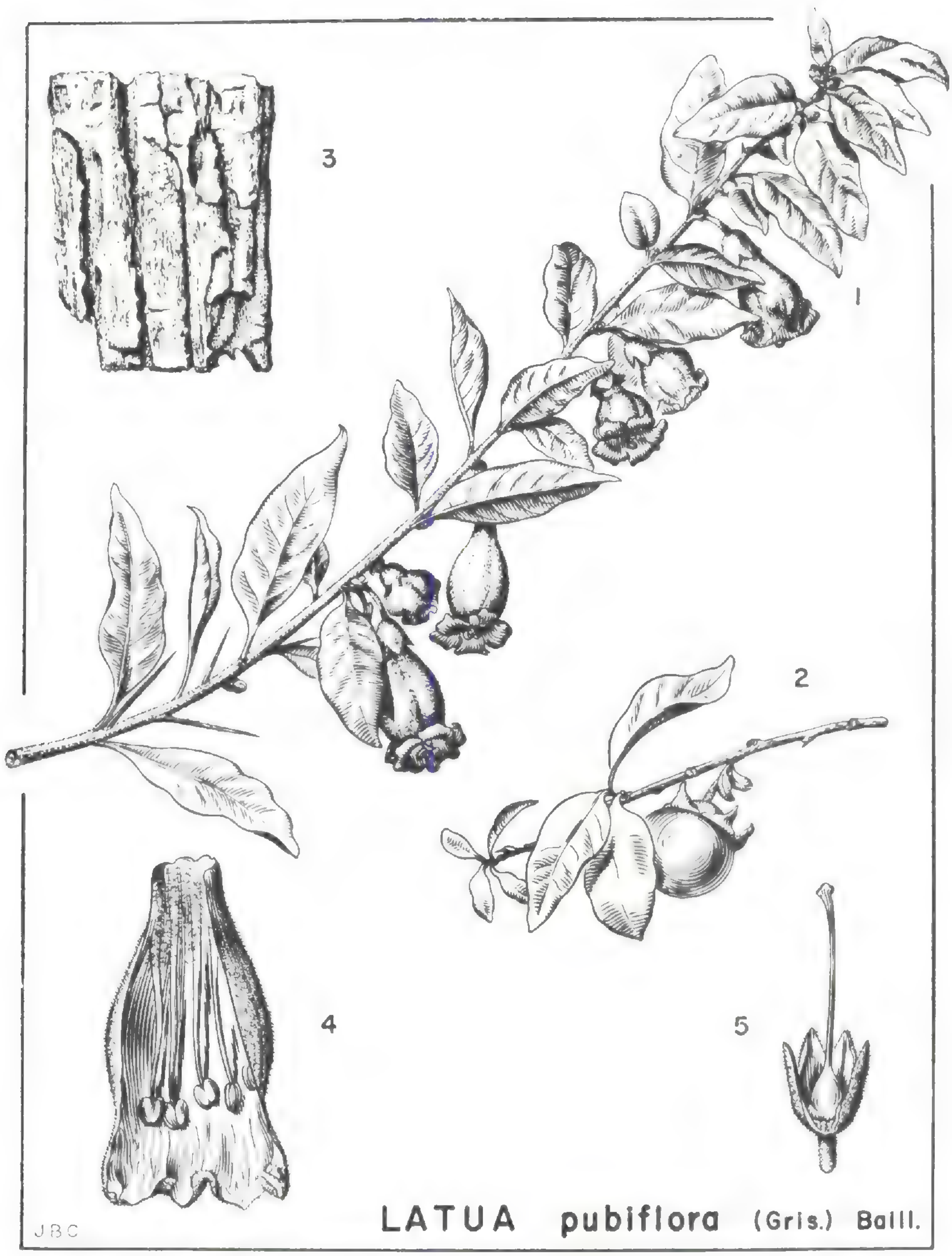
Chile. Chiloé: In sylvis montanis, pr. Ancud, flores coccinei, incolis Taio, Jul.m. *W. Lechler 880* (type, GOET, not seen; photograph of type, GH; isotype, K).—Chiloé; 1848, *Lobb s.n.*(K).—Ancud, frutex venenosissimus; 1861, *Philippi s.n.*(K).

Llanquihue: Along roadsides and in pastures between El Ñadi and Estero Mañio, Cordillera de Zarao; 22-III-1969, *T. Plowman 2609* (ECON, GH, K).—Tree 10 m. tall in woods behind church in El Ñadi, Cordillera de Zarao, 300 m. elev.; 23-III-1969, *Plowman 2613* (ECON, GH, K).

Osorno: San Juan de la Costa; 1-X-1938, *C. Rudolph 5507* (Herbarium, Universidad Austral, Valdivia=VALD).—San Juan de la Costa; 23-III-1939, *J.L. Morrison 17613* (GH, K).—Aleucapi; 14-II-1944, *Rudolph 5566* (VALD).—Huitrapulli; 30-I-1949, *Rudolph 5595* (VALD). About 10 mi. east of ocean on road to Osorno: 29-I-1958 *W.J. Eyerdam 10528* (US).

Valdivia: Valdivia, *Philippi s.n.* (G, not seen; photograph, GH)—Valdivia; 1863, *Pearce s.n.* (K).—San José, *E.C. Reed s.n.* (K).—Along the shore of a stream, La Ensenada, Corral; 20-IX-1931. *H. Gunckel 3750* (Herbarium, Facultad de Quimica y Farmacia, Univ. de Chile, Santiago=FARM). La Ensenada; 16-X-1935, *Gunckel 79* (K).—Chaihuin; XII-1936, *Gunckel 11824* (FARM).—Bima District, west of La Unión, Cordillera de la Alerce, 500–900 m.; 11-II-1958, *Eyerdam 10640* (US).—Cordillera de la Costa near Valdivia; X-1962, *K. Kubitski 371* (VALD).—Along road from La Unión to El Mirador, 500–700 m., growing at edge of forest and in pastures; 30-III-1969, *Plowman 2643* (ECON, GH, K).

Plate III



Latua pubiflora (Gris.) Baill. 1, flowering branch, one-half natural size. 2, fruiting branch, one-half natural size. 3, portion of bark, natural size. 4, excised corolla, approximately natural size. 5, calyx with ovary, approximately natural size.

Drawn from *T. Plowman 2643* by Joshua Clark

Latua was first described in 1854 by Grisebach as a new species of *Lycioplesium*—*L. pubiflorum*—from a specimen collected by Lechler near Ancud in Chiloé. In 1858 the Chilean naturalist R.A. Philippi described the same plant as a new genus *Latua*, using the specific epithet *venenosa* (1858, 1864). The correct combination *Latua pubiflora* was first made by Baillon in 1888, not by Philippi as stated by Wettstein (1891) and Reiche (1910) (see Hunziker, 1960). The name *Latua venenata* Phil. appeared as an error in Hooker's Botanical Magazine (1863) and has been perpetuated in synonymy by several authors.

Latua pubiflora is found sporadically in the coastal mountains of southern Chile between 40° and 43° latitude from the province of Valdivia to Chiloé (see Plate IV). This region has a very wet climate with over 2540 mm. (100 in.) of rainfall annually. *Latua* occurs primarily in the middle elevations of the cordillera between 300 and 900 m. (900 2700 ft.).

The plant grows usually as a tall shrub along clearings and in secondary forests. Due to extensive deforestation for timber and grazing, much of its present range is now occupied by fields and pastures. *Latua* has adapted especially well to these open conditions and is now becoming a weed along roadsides and in open places. It spreads easily by adventitious branches from the underground parts, thereby thwarting efforts to eradicate it by cutting. In shaded woodland, *Latua* may reach a height of ten meters, growing in association with *Eucryphia*, *Laurelia* and *Chusquea*. Although locally common, it is known from relatively few localities.

In the northern provinces of Osorno and Valdivia, *Latua* begins to flower at the beginning of the rainy season in October, producing fruit in February and March. Further south, where there is less seasonal

THE KNOWN DISTRIBUTION OF LATUA PUBIFLORA

Insert map taken from Goode Series of Base Maps, No. 203, Univ. of Chicago.

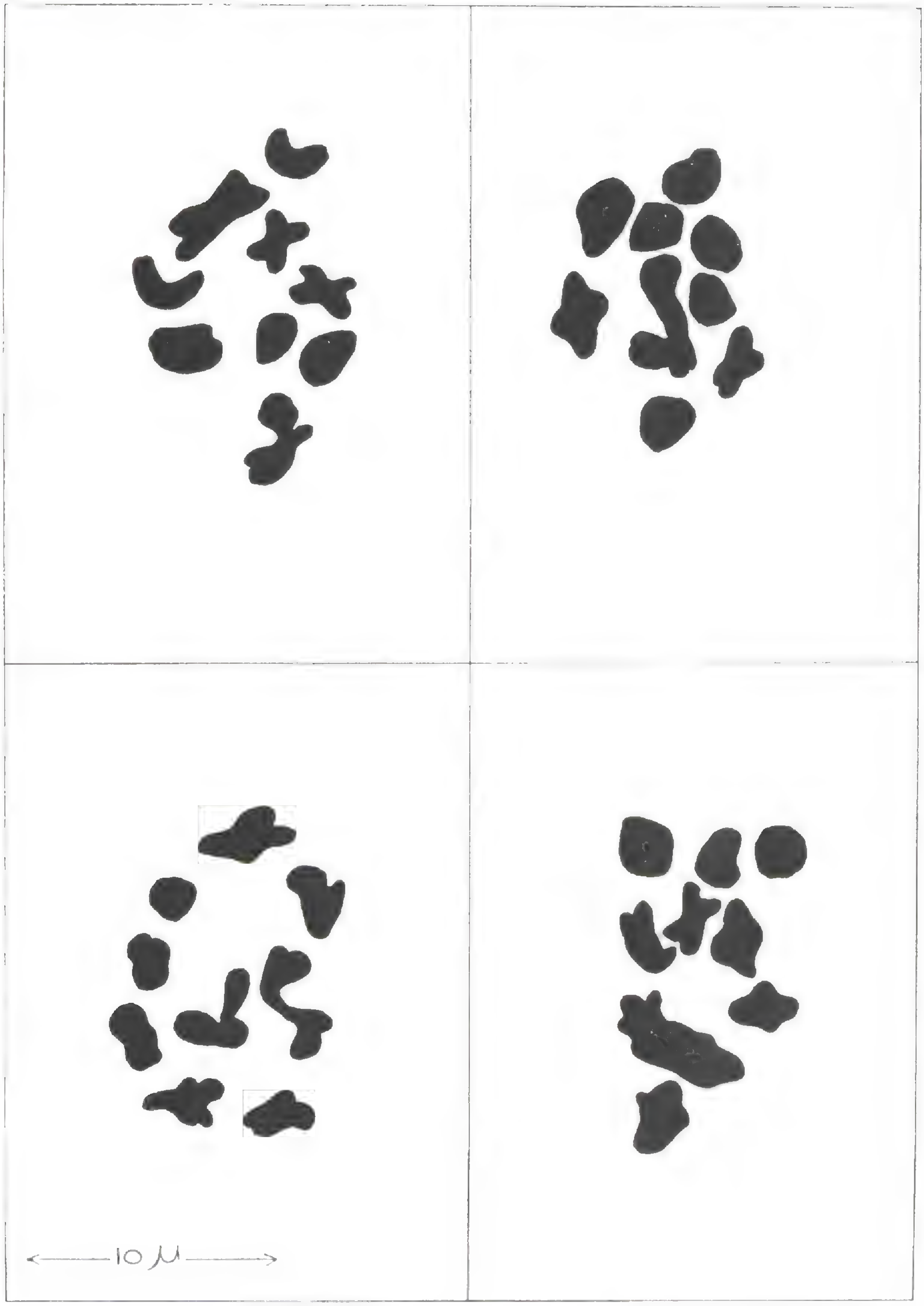
change in precipitation, the plant flowers in March (Llanquihue) and July (Chiloé). There may be more than one flowering a year, but we have not observed this.

Latua is pollinated by hummingbirds, as might be suspected from the reddish, tubular and pendulous flowers. The statement by Mariani (1965) that birds and animals avoid the branches of *Latua* is probably a folk tale based on the plant's evil reputation.

There has been some discussion about the color of the flowers of *Latua* (Scala, 1920; Gunckel, 1933). The label on the type bears the words *flores coccinei*, i.e. deep red. Other authors have referred to them as violet (Murillo, 1889), red (Wettstein, 1897) and dark violet or *atro-violaceus* on the chromotaxy scale of Saccardo (Gunckel, 1933). Plowman observed flowers from several localities and noted that there is some variation but that they are usually magenta (Horticultural Color Chart 27/1).

Young anthers were collected and preserved in Carnoy's solution (Voucher specimen = *Plowman 2643*). Meiosis in the pollen mother cells showed metaphase figures with nine bivalents (N=9), (see Plate V). This is an uncommon number for the Solanaceae, where the base number 12 is very prevalent. However, nine pairs of chromosomes have been reported for several genera in the family, including *Fabiana*, *Nierembergia*, *Petunia* and *Nicotiana* (Darlington and Wylie, 1955).

Latua has been placed in various parts of the Solanaceae, since different investigators have used different criteria for delineating the tribes. Bentham and Hooker (1876) included *Latua* in the Solaneae on the basis of the valvate aestivation of the corolla, removed from such genera as *Lycium* and *Atropa* with imbricate aestivation. Wettstein (1898), considering the number of cells in the ovary a more important character, placed *Latua* in the



METAPHASE CHROMOSOMES OF THE FIRST MEIOTIC DIVISION IN LATUA PUBIFLORA. N=9

Solaneae, subtribe Lyciinae, along with *Lycium* and *Atropa*. Until more work is done on the phylogenetic relationships in this family, these considerations will remain problematical.

The generic epithet *Latua* was taken from the native Mapuche name for the plant. Two variants of the name have appeared in the literature: *latúe* (Philippi, 1858; Lenz, 1904; Reiche, 1910) and *latué* (Murillo, 1889; Valenzuela, 1917; Gunckel, 1959). Plowman recorded a third variant *latuy*, in use at Puerto Montt in the Province of Llanquihue. Most probably several variations in pronunciation exist from one locality to another. *Latúe* and the longer form *latue-hue* are translated: "that which causes (something) to die". These forms are derived from the Mapuche words *lan*, "to die"; *tu*, a causative particle; and *hue*, "the instrument with which something is done" (Febrés, 1765; Lenz, 1904; Valenzuela, 1917). This native name for the plant indicates an explicit recognition of its poisonous nature.

The Spanish names of *Latua* also reveal a knowledge of its toxic properties: *palo mato*, literally "the tree that kills", meaning the same as latúe (Philippi, 1858); *palo de los brujos* (Philippi, 1858), *árbol de los brujos* (Lenz, 1904) and *palo de bruja* (Philippi, 1869; Miranda, 1918), all meaning "witches' tree".

Latua should be regarded first as a poisonous plant. Its toxicity has been frequently mentioned in the literature (Murillo, 1889; Dragendorff, 1898; Reiche, 1901; Lewin, 1929), although there are very few records of actual poisonings. Accidental poisonings are apparently frequent, due to the superficial resemblance of *Latua* to a commonly used medicinal plant of the same region, the *tayu* (*Dasyphyllum diacanthoides* (Less.) Cabr. = *Flotowia diacanthoides* Less., Compositae). This confusion was first mentioned by Philippi (1861) in his

Plate VI

Habit of *Latua pubiflora* growing in open pasture, Cordillera Pelada, Province of Valdivia, Chile. Photograph by Hans Klempau.

original account of *Latua*, in which he reported several cases of inadvertant poisonings:*

> It has been six years now since I first learned that the Indians of the Province of Valdivia possess a secret way of producing insanity with a poisonous plant, for a long or short time depending on the dose. It is considered with great secretiveness. Padre Romualdo, a missionary in Daglipulli, succeeded in learning that the plant is a tall shrub called *latúe* which grows in the forests of the coastal mountains. He was finally able to obtain a branch of it. This had no leaves, however, since the Indian who brought the plant thought that the Padre wanted it in order to examine its poisonous qualities which lie mainly in the bark. Later, I learned the details of *latúe* from Señor Juan Renous. The shrub is very similar in its growth, thorns and leaves to *tayu* or *palo santo*, but the flowers are like *Sarmienta repens* R. & P. in their size and shape. . . . Of the fruit, Señor Renous had nothing to report, but he did tell me of several cases of intentional and unintentional poisonings. The latter occur quite readily since, as mentioned, the shrub is so very similar to *tayu* whose bark is used externally and internally in the form of a decoction for bruises, blows caused by falls or kicks, etc. He related to me among others the following case which had just recently occurred. One of his woodcutters had suffered a strong blow with the blunt end of his axe and went into the forest to get some bark of *tayu* for it. He took instead *latúe* and drank a concoction of this poison. He became insane almost immediately and wandered into the mountains. He was found three days later in an unconscious state. Several days were required for his recovery, although he suffered severe headaches for several months. The fruits are just as poisonous as the bark and in their color and size somewhat resemble young apples. Some people who were traveling from Osorno to Maullín, where *latúe* also grows, mistakenly ate a few fruits. They arrived at Maullín completely bewildered and nearly unconscious. Unfortunately, I have none of the details of the symptoms which the ingestion of *latúe* produces, nor of the antidote which the Indians employ to combat the dire effects of poisoning.

Here and elsewhere (Mariani, 1965), there are references to malevolent and criminal uses of *Latua*. Several natives from Llanquihue (Río Frío) told us of such deliberate poisonings to produce insanity or death. It is

* Translated by T. Plowman.

Flowering branch of *Latua pubiflora*. Photograph by HANS KLEMPAU.

occasionally suspected that insane persons have been given *Latua* by an enemy or sorcerer. This belief arises in great part from superstitions associated with the use of the plant in magical practices.

It has been frequently stated that the ingestion of the juice of the leaves and fruits of *Latua* causes death (Guajardo, 1890; Urban, 1934; Mariani, 1965). We have not, however, encountered any actual cases of fatal intoxication. *Latua* has also been credited with aphrodisiac properties (Eyerdam, 1958, herbarium label; Mariani, 1965) and has been employed as an ingredient in love potions (Bodendorff and Kummer, 1962). Although this use has not been confirmed, it is interesting to recall that the seeds of *Datura Metel* L., containing the same alkaloids as *Latua*, were commonly utilized in India for the identical purpose (Safford, 1920).

Latua was employed formerly as a fish poison by the native Chileans. Pomar (1901) wrote that the juice of *Latua*, as well as that of *Drimys Winteri* Forst., was placed in the still water of rivers and caused fish to become torpid and easily caught.

Local inhabitants in Llanquihue Province informed Plowman of the common methods of preparing *Latua*. This knowledge seems to be rather widespread among native farmers. Padre Leandro Serna (1969) of Río Frío mentioned the following method of taking the plant, stating that the bark of a young branch with plenty of sap is placed in hot water. The resulting liquid is served in a cup of wine, coffee or soup, or in a cigarette. Another informant asserted that the leaves or stem are boiled for two hours before drinking. One-half cup of this decoction supposedly will produce intoxication.

The effects of taking *Latua* are still rather poorly known. Those symptoms which have been recognized closely resemble a characteristic belladonna intoxication.

A native informant described the physical effects to be dry mouth and hot feverish feeling in the body; other effects are marked dilation of the pupils (Miranda, 1918) and frothing at the mouth (Serna, 1969). Effects on the central nervous system reportedly include acute mental disturbances and "insanity" (Philippi, 1869; Reed, 1892; Gotschlich, 1913), as well as convulsions, delirium and hallucinations (Murillo, 1889). Mariani (1965) has described these cerebral effects as intense psychomotor agitation accompanied by delirium which corresponds to acute, exogenous, toxic psychosis. Symptoms of intoxication may occur immediately after ingestion (Philippi, 1868) or as long as 24 hours later (Serna, 1969). Some symptoms, especially headaches, may last for weeks or even months.

There are several antidotes known and used in local medicine to combat the effects of *Latua* poisoning. Most frequently mentioned is the ubiquitous *hierba mora* (*Solanum nigrum* L., Solanaceae). (Murillo, 1889; Mariani, 1965; Sparre, 1970). A decoction of *mora* is drunk for eight days while fasting. Compresses soaked in the infusion are wrapped about the head and neck or rubbed on the back. Other plants similarly used are *culle* (*Oxalis* sp., Oxalidaceae) and the fruit of *espino negro* (*Rhaphithamnus spinosus* (A. Juss.) Moldenke, Verbenaceae).

A rare account of the action of *Latua* is given by Dr. Benkt Sparre, Curator at the Museum of Natural History of Stockholm. At the time of his self-experiment, he was Professor at the Universidad de Concepción (Chile). In a letter to the authors, he describes his experiment in the following way:

Dec. 12, 1953—*Latua pubiflora* was collected at La Posada, about 3–4 kilometers north-northwest of Maullín (Llanquihue, Chile) *Sparre and Smith 331* (material in herbarium at Concepción and Smithsonian Institution, Washington, D.C.), sample: Smith 119-H-E (Beltsville, Maryland, U.S.A.).

According to explanations by elderly villagers of La Posada, who had not tried latue themselves, an infusion was prepared in the evening with green leaves and bark. It was said that only "los hechiceros" (witches) used latue. Intoxicated and with an appropriate refill from a "sub-hechicero" (witch's apprentice), they could dance and preach for a week. None of my informants had seen this, but they had heard it from old people. According to the same informants, "los hechiceros" could quickly recover with a drug from a *Solanum* species of the section *Morella* (to which *Solanum nigrum*) belongs. Some of these species were collected nearby, but my friends could not tell me which they were. They only knew the vernacular name, "hierba mora", which is *Solanum*, but as we know, the vernacular names mean very little. It might have been something which looked like *Solanum* "hierba mora".

Jan. 1, 1954.—In the evening, just prior to a fête-champêtre at Centinela where we lived in an agricultural college, about 5 centiliters of the infusion were taken. After approximately three hours, I noticed extreme dryness in my mouth, a strong urge to spit, which was made difficult due to the fact that the saliva dried to a whitish and later more solid froth. A strong urge to urinate was also felt. This was unfortunately impossible as the urine emerged just one drop at a time though repeated attempts were made.

Somewhat later, possibly three or more hours after the consuming of the infusion, I felt a "heavy" intoxication. This was not like alcoholic inebriation, where you have rather happy and agreeable thoughts and events before a hazy state occurs. This was an immediate and almost complete loss of memory.

Without my knowledge, my friend, Dr. Earl E. Smith, Beltsville, brought me home and put me to bed. In my journal I noted that I "missed my chance with the girl", but later Smith consoled me and told me that the girl in question had a face like a horse although she had a beautiful body. Even this mistake might have been due to the infusion.

Jan. 3, 1954.—I awoke in the middle of the night with, as I remember, a kind of claustrophobic feeling, or it might have been a normal feeling that woke me up followed by the claustrophobia. I could not find the toilet and started to run down the passage. According to what I remember, it was dark and I hit walls and doors. My nose started to bleed. In one way or another, I went into Smith's room and when I felt something that seemed to be a bed, I crept down—to Smith's surprise and alarm. He later told me that with force he managed to lead me back to my own room and locked me in.

I had quite a hangover the next morning, although I was fairly clear in the head, and wanted to take part in a previously planned excursion. At breakfast, with Prof. Lars Brundin, Stockholm, Docent Kuno Thomasson, Uppsala (born in Estonia), Dr. Heinz Löffler, Vienna, and a few Chileans among others in attendance, I suddenly spoke to those present in a completely unknown language without looking at anyone present. Unfortunately, I remember nothing from this conversation, nor with whom I thought I spoke. Possibly it was one of the last of the Araucarian hechiceros who finally had found a chap to talk with. What I remember is that I suddenly jumped out of my chair, thinking that someone wanted to beat me. It was my own hand which hung on the back of the chair which frightened me. I was unable to read a message on a piece of paper I had received before breakfast.

During the day-long excursion, I was periodically fairly clear, periodically drowsy. During these latter periods, I saw the forest around the road as some kind of Russian boyar-ballet in heavy costumes. Oddly enough, green was the dominant colour.

In the afternoon I felt fairly well restored, though my working capacity was less than usual. I still could not read.

Jan. 4, 1954.—Smith and I proceded on our trip at a normal pace, though in the morning I still could not read. In the evening, I wrote notes in my journal, but I had difficulties in keeping to the lines.

Jan. 5, 1954.—Completely normal sight. Normal condition.

This account as well as the Spanish names for *Latua* —"palo de bruja" and "árbol de los brujos"—suggest that the plant plays a role in magic and shamanism. Although we now know that this is true, the role has never been described in any detail. In 1892, Reed first wrote that *Latua* was "much used by curanderos to produce convulsions and insanity". Gusinde (1936) mentioned that the plant was employed by the *machi* or shaman for its poisonous qualities. Since *Latua* is intimately associated with certain magical and religious practices of the indigenous Chileans, it is important to understand the relationship between these people and their magical plants, and especially the role of the *machi*.

The inhabitants of southern Chile belong to several groups, all of which are now referred to as Mapuche or

Araucarian. The southernmost tribe, known as Huilliche and extending to Chiloé, are the people who know and use *Latua*. As in many other South American tribes, the Mapuche nearly always have one or more medicine men or shamans, known as *machis*, who are responsible for curing the sick through their magical powers and with medicinal herbs. In the Mapuche psyche, it is believed that all diseases and death are caused by certain evil spirits called *wecuvu*. *Wecuvu* may exist anywhere and in many different forms or beings. Man has very little control over these ever present demons, except through the machi who is able to interpret and assuage their evil influences. The primary function of the *machi* then is to heal sickness by discovering and exorcising the appropriate *wecuvu* which has bewitched the patient (Cooper, 1946).

The *machi* is usually a woman, although in former times this occupation was served by men or male transvestites (Latham, 1922; Faron, 1964). In early youth, the future *machi* receives a divine revelation, after which she dedicates her life to this role in the community. She receives instruction and training from older *machis* who impart their knowledge of magic and healing to the young novitiate. Persons who enter this profession are usually extremely nervous and psychic. Not uncommonly they are epileptic and readily disposed to trances, auto-hypnosis and clairvoyant states. During these altered states of consciousness, they are able to communicate with the spirit world and to serve as intermediaries between the people and the supernatural powers.

The *machi's* training period is devoted to developing her psychic abilities through various methods: intense mental concentration and meditation, chanting, fasting, violent exercise in the form of whirling dances, auto-hypnosis and the constant use of narcotics. She also re-

ceives extensive instruction in the utilization of native medicinal plants which form the physical basis of her healing powers. She is at once doctor and magician, playing a decidedly benevolent role in the community, in contrast to the sorcerer or *kalku* whose role is decidedly evil (Faron, 1968). Using her magical powers, the *machi* may determine the cause of someone's death, foretell the future, bring good or bad luck and discover stolen objects. Such acts of divination are common shamanistic practices among New World peoples.

The curing ceremony of the *machi*, known as the *machitun*, is a complex ritual deeply rooted in cultural traditions. This ceremony varies considerably from place to place, for each *machi* conducts the rites as learned in her own region. There are, however, several practices in common throughout the area. The trance state of the *machi* is nearly always basic to the ceremony. Other aspects are the use of the sacred canelo tree (*Drimys Winteri*), the playing of a small drum (the *kultrun*) by the *machi* and the fumigation of the patient with tobacco smoke. The *machi* usually has a sacred pole or *rewe* constructed near her hut. This consists of a trunk of canelo with rough-hewn steps cut in the form of a ladder. It is planted in the ground with smaller branches tied around it.

During the *machitun*, the *machi* smokes constantly and plays her drum with a monotonous rhythm. She is usually accompanied by one or more assistants who dance and sing a hypnotizing chant, designed to intensify the *machi's* trance. When the *machi* reaches a highly transformed state of mind, she climbs up the *rewe* while her helpers dance around. She then falls into a swoon, often epileptic in nature, and is caught in a blanket held by her assistants beneath. At this time, the source of the sickness or perpetrator of evil is revealed to her. The

machi then mutters incoherently, and her assistants interpret the divinatory mumblings.

In addition to this revelatory state, she also employs other means of determining the cause of illness. Often she will kill a lamb and extract the heart; or she may pretend to remove the patient's intestines, which are then magically replaced without a scar; or she will pretend to remove from the patient's body some foreign object, such as a worm or a thorn, which is the presumed source of trouble (Latcham, 1922; Cooper, 1946).

Hallucinogenic and narcotic plants play an important role in the life of the Mapuche shaman. These drugs are normally employed during the *machitun* ceremony and are administered to the young *machi* as part of her education. Certainly these psychoactive plants have a powerful effect on her psyche and enable the *machi* to experience what Castaneda (1968) has called "non-ordinary reality", consisting of trances and hallucinatory states. In this realm of consciousness, she is capable of free exchange with the spirit world from which she derives her magical healing powers. It is not surprising that the plants used to produce these states are considered sacred and secret.

Tobacco has been regarded as the most important narcotic plant of the *machi* (Latcham, 1922). Several strongly intoxicating varieties are known and smoked in ceremonial pipes or cigars, snuffed in powder or chewed. Tobacco is not only smoked by the *machi*, but the smoke is blown upon the patient to purify him. This plant serves a dual purpose of exorcising the demonic spirits and of propitiating the Supreme Being.

A species of *Datura* is also employed narcotically by the Mapuche. *Datura Stramonium* L., known as *miayu* or *chamico*, has been used to discipline unruly children who are fed the seeds in order to narcotize them mildly, while they are lectured by their elders (Gusinde, 1936;

Cooper, 1946). *Datura Stramonium* subsp. *ferox* (L.) Barclay has been used medicinally as an anesthetic (Pérez de Barradas, 1957). We may assume that the *machi*, like her counterparts in other cultures, has a wide knowledge of this plant and all its properties, including its hallocinogenic and trance-inducing effects.

It has only recently been confirmed that *Latua* is employed by the *machi* as a psychoactive agent. This was revealed to Sr. Rolando Toro, a psychologist from Santiago, who attended a *machitun* in Chiloé, in which *Latua* played an integral part of the ceremony. His account follows:

> *Latua* is used in an infusion by the shamans or curanderos, who ingest it during nocturnal ceremonies of a magical nature. After drinking the infusion at 20 to 30 minute intervals, they slowly begin to sing and dance in a circle. The chants are variations on the word latué:
>
> Latué – latué – la – tué
> La – la – la – tué
> Tué
> La – tué
> La – a a – a (slowly)
> La – tué – la – tué – la – tué (fast).
>
> Their movements are monotonous and consist in marking the rhythm by stomping their feet on the ground, along with movements of the head with the arms hanging like wings. The movements are not graceful but rather rigid, like those of catatonia. The dances last for four to six hours with intermittent prayers:
>
> "Con un tizón ardiendo
> Cristo quema el mal
> de vientro de N."
>
> With a firebrand
> Christ burns the evil
> from the belly of N. (here the name of the patient).
>
> The cure consists in driving the demons from the body of the patient. To do this, he is slapped with branches of *palqui* (*Cestrum Parqui* L'Her., Solanaceae) and is made to drink a potion which makes him vomit. Then his face is covered with the genital skin of a goat. The cure embraces every type of physical and mental infirmity and is always given at night. These meetings are equivalent to a witches' sabbath with curative ends.

We do not know how widespread is this use of *Latua*, although it must be known to most of the *machis* in the region in view of their familiarity with the medicinal flora. It is of interest to note the Christian influence which has been incorporated into a primarily indigenous ceremony. This mixture of religious elements is reminiscent of shamanistic practices in other areas, such as the ceremonial use of *ayahuasca* and *San Pedro* in Peru, magic mushrooms and *peyote* in Mexico. *Latua* must now be appended to the growing list of plants used in magico-religious rites for hallucinogenic purposes.

Experimental

Material

The numbers of the voucher specimens given in the table and legends to figures refer to the collection number of T. Plowman. Voucher specimens have been deposited in the Economic Herbarium of Oakes Ames, Botanical Museum of Harvard University.

Isolation of Alkaloids

20 g. of the powdered plant material and 10 g. of diatomaceous earth were stirred with 30 ml. of chloroform and 10 ml. of a 1 M solution of sodium carbonate to form a homogeneous mixture. The mixture was packed in a glass column (1.7 x 60 cm.) and eluted with 300 ml. of chloroform (flow rate 1 ml./min.). The eluate was passed through another column of the same size packed with a mixture of 15 g. of diatomaceous earth and 2 ml. of 1 M phosphoric acid. The alkaloids were eluted with 250 ml. of chloroform saturated with ammonia and passed through a column (1.7 x 8 cm.) containing 10 g. of aluminium oxide (flow rate 1 ml./min.). The chloroform extract was dried with anhydrous sodium sulphate, filtered and evaporated to dryness(Pharmacopoea Nordica, 1964).

Gas Chromatography (GC)

Gas chromatographic analysis was performed with an F & M Model 400 apparatus equipped with hydrogen flame ionization detection system. The column support, 100–120 mesh Gas Chrom P, was size-graded, acid-washed and silanized according to the method described by Horning *et al.* (1963). The coating was applied by the filtration technique (Horning *et al.*, 1959). The stationary phase used was 5% SE-30 (2.25 m. x 3.2 mm. glass tube). The column was operated at 200° and the injector block and the detector chamber were kept at 250°. The amount of alkaloids in mg./100 g. dry plant material and the percentage of each alkaloid in the alkaloid mixture was determined by planimetry using atropine and scopolamine as standards.

Gas Chromatography – Mass Spectometry (GC-MS)

The principles of the technique have been described earlier (Holmstedt and Lindgren, 1967). The mass spectrometry work was carried out with an LKB 9000 gas chromatograph-mass spectrometer. The ion source was 270°, the electron energy was 70 eV and the electron ionization current 60 A, respectively. The separations were made on a column (2 m. x 3.2 mm.), packed with 5% SE-30 on Gas Chrom P at 210°.

Results

The results are presented in Table I and Plates 6, 7.

Discussion

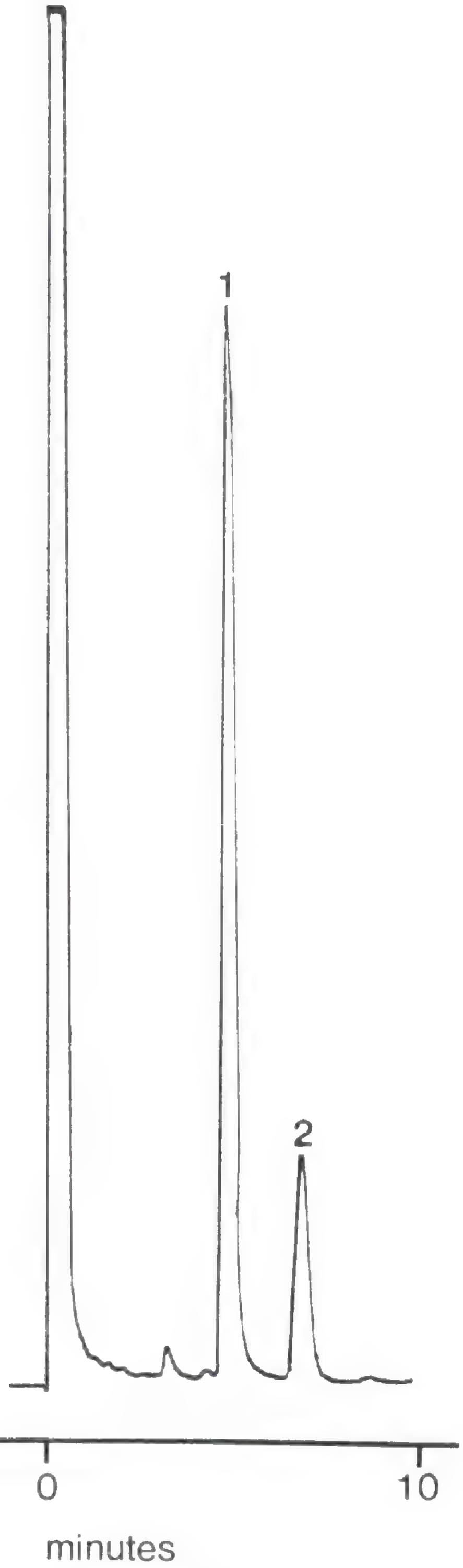
The first chemical investigation of *Latua pubiflora* was that of Vásquez in 1864. Vásquez made both an alkaline and an acid extract of the plant but was not able to find any alkaloids. He compared the resin to that of *Cannabis sativa* and promised continued investigations of its active principles. These never appeared. The next investiga-

TABLE I

DISTRIBUTION OF ALKALOIDS

Species	*Part of Plant*	*Alkaloids: MG/100 g Dry Plant*	*Alkaloids*	*%*
Latua pubiflora No. 2609	Leaves	185	Atropine	70
			Scopolamine	30
	Stem	496	Atropine	87
			Scopolamine	13
Latua pubiflora No. 2643	Leaves	70	Atropine	86
			Scopolamine	14
	Seeds	91	Atropine	86
			Scopolamine	14
	Stem	240	Atropine	92
			Scopolamine	8

PLATE VIII

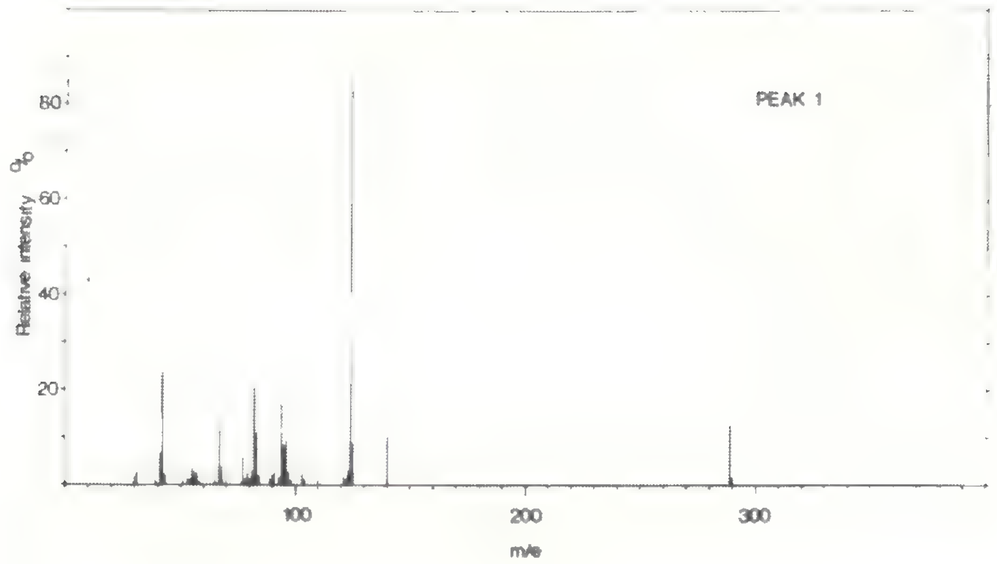


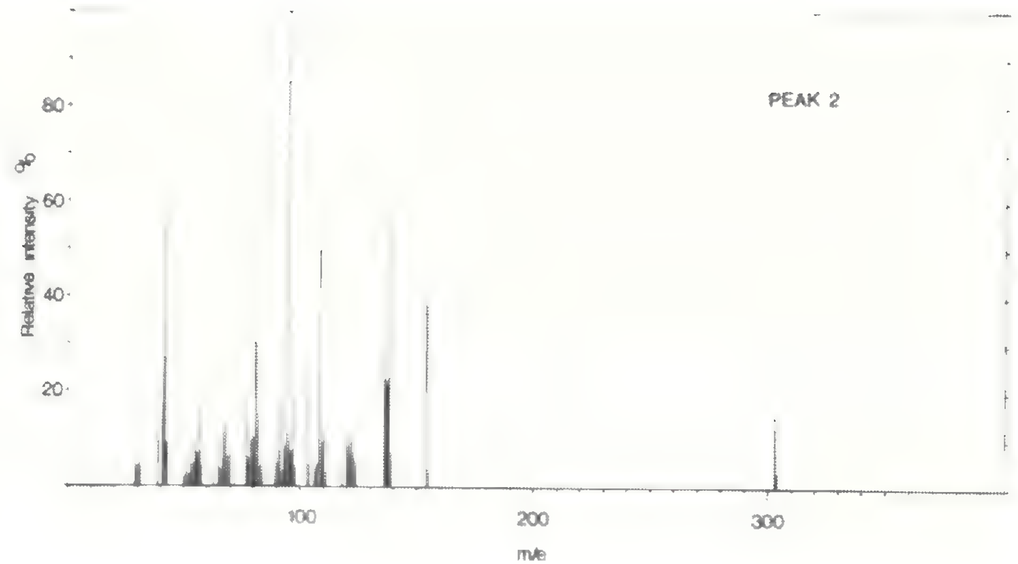
Gas chromatogram of alkaloid fraction from leaves of *Latua pubiflora* (*Plowman 2609*). Conditions: see Experimental.

tions seem to have been conducted by Pouquet (1914), Alvarado (1918) and Miranda (1918). Miranda has summed up the previous investigations. He himself identified, by the methods available at the time, atropine in *Latua*, using various precipitating reactions, confirming also the parasympatholytic action of the extract on pupillary size of animals and man. Miranda presumably based his original assumption that atropine represents the main constituent on botanical rather than chemical proofs. His finding was confirmed in 1959 by Silva and Mancinelli who isolated 0.015% of atropine from the leaves. Not until 1962 were Bodendorff and Kummer able to identify another alkaloid in the plant: *viz.* scopolamine. The amount of alkaloids calculated on the whole plant was scopolamine 0.08% and atropine (or hyoscyamine) 0.18%. The highest content of alkaloids was found in the leaves. The stem contained less, and the seeds lacked alkaloids. This is in contrast to our own findings. The present examination demonstrates the highest amount of alkaloids in the stem, while the seeds and leaves contained less but a still substantial amount of atropine and scopolamine.

Acknowledgments

Field studies pertinent to this work were conducted by Plowman in Chile in 1969. We are most grateful to all the persons there who facilitated these studies with generous hospitality and assistance. We would like to thank the following persons: Dr. Carlos Muñoz and Dra. Mélica Muñoz (Museo Nacional de Historia Natural), Dr. Hugo Gunckel, Dra. Eugenia Navas, and Dr. Jorge Mardones (Universidad de Chile), Ing. Patricio Montaldo and Mario Bernales (Universidad Austral), Padre Leandro Serna (Río Frío), and Claudio Urrea (Temuco). We also express our thanks to Rolando Toro (Santiago)





Upper panel: mass spectra of compound in effluent from peak 1 and 2 from alkaloid fraction (Plate VIII).
Lower panel: mass spectra of reference compounds. Conditions: see Experimental.

for sharing with us his notes on *Latua* and to Dr. Benkt Sparre (Museum of Natural History, Stockholm) for permitting us to publish part of his diary. We appreciate the help of Hans Klempau (Universidad Austral) who provided the photographs of *Latua*. Drs. Antonio and Carmen Krapovickas (Universidad del Nordeste, Corrientes, Argentina) kindly lent their excellent laboratory facilities for chromosome studies. We are thankful to Professors Richard Evans Schultes and Bo Holmstedt for their encouragement and support in conducting this work. The following herbaria furnished specimens and information: Gray Herbarium, Cambridge, Massachusetts (GH); U.S. National Museum, Washington, D.C. (US); Royal Botanic Gardens, Kew, England (K); British Museum, London (BM); Systematisch-Geobotanisches Institut, Göttingen, Germany (GOET); Facultad de Química y Farmacia, Santiago, Chile (FARM); Universidad Austral, Valdivia, Chile (VALD).

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CHARLES SCHWEINFURTH
1890–1970

An Appreciation

Charles Schweinfurth was a gentleman, scholar and scientist. He has made an indelible mark on the science of orchidology, and his influence will be long remembered in the Botanical Museum of Harvard University, the institution which he served for many years.

Born in Brookline, Massachusetts, on April 13, 1890, the only child of Julius Adolf and Mary Frances Schweinfurth, he attended public schools there. Entering Harvard College in 1909, he concentrated in chemistry, although, with his childhood interests in natural history, he did courses in biology, becoming especially drawn to taxonomic botany. After receiving the AB. degree cum laude in 1913, he devoted the following year to graduate studies at Harvard.

An attack of poliomyelitis during his college years left him slightly paralyzed in the right arm. When he did complete his studies, medical advisors counselled against his following a career involving work in chemical laboratories.

Charles' father, a world renowned architect, was a man of independent means, but his philosophy rebelled at permitting his son to live on accumulated wealth without working. At this time, the Ames Botanical Laboratory in North Easton, Massachusetts, functioning at the home of Professor Oakes Ames, was entering a very active period of research in orchidology. Professor Ames contracted young Schweinfurth in 1914 to care for his living collection of orchids.

It was not long before Ames, recognizing Charles'

extraordinary meticulousness and his uncanny, almost photographic, memory for the orchids, transferred him to his herbarium to aid in the identification of ever increasing shipments of orchid collections arriving from around the world, especially, at that time, from the Philippines and southeast Asia.

Dedicating himself with typical zeal to this new task, Charles became, in a surprisingly short time, proficient in this most complex plant family and was soon recognized as one of the world's leading orchidologists. Orchids remained his prime responsibility for the rest of his life.

When, in 1931, Ames transferred the Orchid Herbarium of Oakes Ames to the Botanical Museum, Charles came to Cambridge and, as Research Associate, spent the rest of his life in the Museum in orchidological research. After retirement, he continued his studies daily on the absolutely precise schedule so typical of his life and philosophy, until they were interrupted by illness about a year before his death.

Filially devoted to the Botanical Museum, 'Schweiny', as he was affectionately known amongst his closest colleagues, gave his time and efforts happily in sundry quiet ways towards the strengthening of this institution. For many years, he assisted in the editing of the *Botanical Museum Leaflets*, setting an example of the strictest accuracy in this work.

Charles' taxonomic and monographic research, including both Old and New World orchids, resulted in voluminous publications, which will long serve as models. His earliest work dealt with the Philippine flora. His basic work with Ames and F. Tracy Hubbard on *Epidendrum* led to a monograph on this complex genus. The major research of his life, however, was embodied in his monumental five volume *Orchids of Peru*, based on investigations that spanned 30 years. This work repre-

Plate X

Charles Schumpelick

Plate XI

CHARLES SCHWEINFURTH

A drawing made by Elmer W. Smith in 1958.

sents the first orchid flora of an Andean country and, as such, will always remain a basic tool. Published from 1958 to 1961, an addendum appeared only days after his death. This great contribution was recognized when, in 1948, at the Third South American Botanical Congress in Lima, the Peruvian Universidad Mayor de San Marcos awarded him the high distinction of Honorary Professor of Botany and, in 1962, when the Universidad Nacional del Cuzco gave him the same title.

A man of extreme compassion for others and of happy disposition, who could laugh hardest at a joke directed to himself, he personally and financially supported with deep sincerity numerous political and social causes. He had that fortunate propensity of devoting himself wholly to his research during working hours and completely transferring his interests to extra-curricular activities upon leaving his laboratory. An avid field botanist of the local flora, he was a mainstay of the New England Botanical Club for 58 years, serving as its corresponding secretary from 1949 to 1965. He was a keen amateur ornithologist, an accomplished skater, a dedicated photographer and an enthusiastic world traveller.

When, in 1963, he married his lifelong friend, Miss Maria Elizabeth Westergren, a lady with many similar interests and philosophical outlooks, there began a period that visibly brightened both lives and filled his final years with a happy companionship.

He died peacefully at his home in Wellesley, Massachusetts, on November 16, 1970, survived by his wife.

A classicist who read Latin for pleasure, he often quoted the wisdom of the ancients in evaluating modern problems and manners. I shall remember one of these quotations, since, to me, it explains so much of Charles' philosophy. It is Plutarch's: "It is indeed a desirable thing to be well descended, but the glory belongs to our ancestors".

—Richard Evans Schultes

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, APRIL 7, 1972 VOL. 23, NO. 3

THE DEATH OF CLAUDIUS
OR
MUSHROOMS FOR MURDERERS

BY

R. GORDON WASSON

> *Tu illos boletos, voluptarium venenum, nihil occulti operis iudicas facere, etiam si praesentanei non fuerunt.*
>
> —Seneca the Elder, Epistle XCV to Lucilius.

For murderers there is only one kind of mushroom worth considering: *Amanita phalloides*. Almost everyone who dies from mushrooms dies from it; and most of those who have eaten it have died from it. Even a small piece of the cap may kill a grown man. Specimens are easy to identify and easy to find in season—in our latitude from August into October. Their poisonous virtue survives cooking, freezing, drying. To speak more accurately, the deadly species are three in number, for we must add *Amanita verna* and *Amanita virosa*, but all three resemble each other so closely both in appearance and toxic properties that the murderer, whose ends after all are empirical, will disregard the distinctions as academic. He looks for white gills, veil (or ring), and volva, taking care not to be misled by any of the innocent amanitas, such as the citrina. On the autopsy table the victim shows pathological lesions of the viscera, but unlike the case with arsenic, the pathologist cannot iso-

late the lethal agent, whose identity he must infer from the case history supplied by the attending physician, plus such evidence as can be assembled to show that the victim had eaten the lethal fungi.

From the murderer's point of view, the deadly amanita suffers from one shortcoming: an occasional victim, after days or weeks or even months of shattering illness, slowly recovers and returns to circulation. True, he is only a frail replica of his former self, but he is alive and has foiled the murderer's coup. On the other hand, if the murderer also hates his victim, and if success attends his undertaking, his worst instincts and hopes will have been more than satisfied by the slow progress and horrible suffering that attend the victim's downward course into the grave. The symptoms of poisoning by the deadly amanitas are distinctive, dramatic, and terrifying.

To begin with, the lethal amanitas taste good—on this the abundant testimony of victims shows no dissenting voice. Nothing arouses suspicion as the greedy diner consumes his fateful dish; nor does he suspect anything for many hours thereafter. Indeed, the distinctive mark of this poison, its *véritable signature* as Dr. Dujarric de la Rivière has aptly called it, is the period of absolute quiescence that follows the ingestion of the mushrooms, a period that never lasts less than six hours, and usually ten or twelve, sometimes twenty or even forty or more. The victim goes about his affairs blissfully unaware that the fingers of death are entwining him. Perhaps he speaks with relish of the mushrooms he has eaten, and may ask for another helping of the same kind at the next meal. If they have been served to him intentionally, his murderer, standing by, eyes him with wicked and dissembled solicitude, alert for the inevitable moment. Of a sudden the victim is gripped by appalling abdominal distress, followed by vomiting and *diarrhoea fœtida*. Neither

emetics nor purgatives can help him now, for his system has absorbed the venom during the long period of silent invasion. The initial seizure is followed by utter prostration, which in turn is succeeded by another paroxysm like the first, and this alternation continues, perhaps for many days, until the victim, his pulse fast and weak, succumbs, usually after a delirious phase. The appearance of the patient meanwhile is marked by what the physicians describe as the Hippocratic facies—eyes sunken and staring as though with anxiety or terror, skin over the cheekbones taut and parched, nose pinched, temples hollow, ears leaden and cold, their lobes turned out, lips relaxed, the whole face livid—an appearance that is clear harbinger of imminent dissolution.

Our lugubrious, even sinister, approach to the toxic fungi presents the elementary facts that should be known to any detective story craftsman who resorts to mushroom poison as a device in the construction of a plot. The art of the detective story is a minor literary genre proliferated by the English-speaking peoples. Its leading exponents are often conscientious in their scientific research. But when they invoke mushroom poisoning, they seem incapable of artistic performance, as though the mycophobia peculiar to the Celtic and Anglo-Saxon races inhibited all inquiry into the dark recesses of the repellent subject. Mushrooms remain a mystery to mystery writers.

Before examining the texts, we must mention two other kinds of toxic mushrooms. First and foremost there is *Amanita muscaria*, erroneously regarded by many laymen as preeminently the poisonous mushroom. Its evil reputation far outruns its deserts. It gives its name to 'muscarine', the agent that most physicians and many medical examiners in the English-speaking world regard as synonymous with mushroom poisoning. But

the facts are that muscarine is seldom if ever fatal, that it is destroyed by cooking, and that it exists in *A. muscaria* only in traces. One would have to eat kilograms of fresh *A. muscaria* to induce a muscarine reaction, and far more for a lethal dose. In the English-speaking world this spectacular mushroom labors under a tabu, originally I believe religious, which wielded such power that it seeped out and infected the whole wild mushroom world—the world of 'toadstools'—to the point where the idea of eating them strikes panic into the normal Englishman's being, be he ever so brave. The victim (or beneficiary) of *A. muscaria*, following a stupor accompanied perhaps by vivid dreams, is traditionally imbued with a sense of exhilaration, of living in new dimensions with miraculous mobility; but these are the result of drugs new to science and now for the first time being studied.

Of the remaining toxic mushrooms, there is a peculiar mystery about *Gyromitra esculenta*, a common species much eaten (as its name suggests) in central Europe. Certain it is that at intervals cases occur where an individual dies from this species. The explanation may not be surely known, but if the best opinion available today proves right, *Gyromitra esculenta* offers us a notable fungal peculiarity. It seems that everyone may eat this tasty mushroom with impunity for the first time. But occasionally there is an individual who, if he returns to a mess of the same species shortly thereafter, and if the mushrooms are fresh rather than dried, suffers a dangerous or even fatal anaphylactic shock.

Dorothy L. Sayers with Robert Eustace in *The Documents in the Case* produced the supreme example in English of a mystery story based on fungal poisoning. An eccentric Englishman, George Harrison, made wild mushrooms his hobby (he was obviously eccentric), and

in the end was found dead (as his fellow-countrymen would expect) in a lonely shack. The evidence indicated that he had recently eaten a mess of stewed mushrooms prepared by himself. The coroner after chemical analysis of the uneaten remains of the stew put the death down to accidental muscarine poisoning. The victim's son, Paul, was not satisfied, because he was certain his father, a careful man and excellent amateur mycologist, could never have confused *Amanita muscaria* with an edible species, and in the end he ran down the real culprit, a lover of Paul's stepmother, a villain named Robert Lathom, who in due course was proved to have introduced synthetic muscarine into the stock that had served for the mushroom stew. He was tried, convicted, and hanged. The story is well told, with delightful touches revealing the mycophobic habits of mind of the run of Englishmen. But it suffers from one defect: muscarine is destroyed by cooking and could not have caused the victim's death. Furthermore, the toxicity of fresh muscarine is exaggerated: the chances were excellent that Harrison would survive an uncooked dose. Lathom should have used pieces of *A. phalloides*, not muscarine, and for informed readers, his execution was a painful miscarriage of justice, a tragic sequel to an incompetent performance by Defense Counsel.

Miss Sayers and Mr. Eustace used, or misused, a genuine mushroom. More often English authors create fictional species, tailored to fit their plots. Ernest Bramah in *The Eyes of Max Carrados* tells a story entitled 'The Mystery of the Poisoned Dish of Mushrooms'. It hinges on the peculiar properties of a non-existent fungus on which he bestows a name unknown to mycology, *Amanita bhuroides*. (This name sounds like a misspelled derivative of Burrhus, a personage in attendance at the imperial court of Claudius and Nero.) It is so deadly

that the victim expires within a half-hour of his seizure.

More notable than *Amanita bluroides* is the fictitious "*Panaeolus sherriffoides*", as we shall call the mushroom that the playright R.C. Sherriff devises for his drama *Miss Mabel*. His plot is unhappy, for we are expected to sympathize with a kindly, somewhat demented heroine who poisons her wealthy and hateful sister, the widow Fletcher. The mycophile watches with astonishment as the author, by a very act of creation, invents his mushroom and clothes it with precisely those attributes that the plot requires. It appears in the spring: the daffodils are in bloom and Easter is yet to come. (In nature there are almost no mushrooms then.) It grows fast, progressing noticeably in the course of a night's rain. A cluster of nine serves as the lethal dose, but the playwright suggests that fewer would have sufficed. When cooked, the mushrooms smell like hot rubber, but the smell is successfully overlaid with onions and tomatoes. Most remarkable are the toxic properties. These fungi are a powerful narcotic and put the victim to sleep at once. The widow Fletcher departs this life without pain, her ugly, resentful face assuming in death 'a look of such peace and gentleness' that the audience is presumably reconciled to her hurried departure at the hands of her sister.

Yet another inventor of mushrooms is H.G. Wells in his short story, *The Purple Pileus*. Here a mild-mannered, milk-toast of a man named Coombes, lower middle-class, finds himself browbeaten by his wife and her odious friend, Clarence, to the point of desperation and suicide. He rushes from the house into the woods. He thinks of drowning himself, but suddenly notices all the varied mushrooms around his feet. A purple pileus catches his eye, 'a peculiarly poisonous looking purple', slimy, shining, emitting a sour odor but not disgusting.

Coombes breaks off a piece, and the creamy white of the inside changes in ten seconds to a yellowish green color, which suggests what the modern world knows as a boletus. He remembers that his father had described this very species to him, and they were the deadliest poison. He tastes the thing. It is pungent. He almost spits it out, but then it seems merely hot to the taste and full-flavored, a kind of German mustard with horse-radish. He swallows it. There ensues a curious tingling sensation in his finger-tips and toes. His pulse quickens. The blood in his ears sounds like a mill-race. He loses his balance, falls, forgets everything. While he lies there unconscious, a peculiar transformation takes place in his personality, for after a while he wakes up feeling bright and cheerful, his complexion a livid white, his eyes large and bright, his pale lips drawn in a cheerless grin. The mild little man is now a lion, fit to be master of his house. He goes home, and in a scene of violent retribution he imposes his will on his wife and that noisome friend of hers. He is so successful that the reformation in his household proves lasting, and the whole course of Coombes's life is changed for the better.

Coombes's exhilaration might suggest that he ate *Amanita muscaria*, but Wells expressly distinguishes his purple pileus from that other species, 'the red ones with white spots'. Wells, like Bramah and Sherriff, fills out the necessities of a given plot by inventing the needed mushroom, on which we here might facetiously bestow the name of *Boletus wellsoides*.

Have English authors ever invented flowers or shrubs or trees with which to adorn the English countryside? It seems unlikely. Surrounded by mushrooms on which they never fix their gaze, they usually ignore them, and on the rare occasions when 'toadstools' are needed, they blithely misrepresent them, to make them serve an odious or exotic purpose.

With Wells and Sherriff and Bramah, we observe a peculiar aspect of the mycophobia of the English in its unconscious and spontaneous workings. Doubtless many other examples could be assembled, and we shall mention a few. But first let us note and celebrate one exception. Anne Parish in her novel *The Perennial Bachelor* dispatches one of her characters by means of a dish of mushrooms. Unlike all the other writers about whom we speak, she shows herself thoroughly versed in the properties of the deadly amanita. The episode is only incidental to her plot, and this makes the accuracy of her details even more astounding. It is not as though she had worked hard on mushrooms and then hung her story on them.

In December 1949 *Ellery Queen's Mystery Magazine* published a yarn by August Derleth in which the murderer killed his victim by substituting for morels some specimens of *Gyromitra esculenta*—a species that no villain bent on murder would ever rely on. In *Murder with Mushrooms*, 'Gordon Ashe' (pen name for John Creasey) has his victim die the same night that he dines on poisonous mushrooms—a tragic sequel that could not occur. In R.T.M. Scott's *Ann's Crime*, the victims inhale spores of *Amanita phalloides* that have been concealed in a cheese cloth inside a pillow, and forthwith they die, for no doctor, we are told, could save a person whose head had once touched that pillow! . . . . Has there been a single writer of detective or mystery stories who has done justice to the genuine drama hidden in the properties peculiar to *Amanita phalloides*?

The German author Gustav Meyrink in his *Bal Macabre* deals with mushroom intoxication. The story is drenched with a pathological atmosphere artfully contrived. There is much about mushrooms in the narrative, but the hallucinations that hang over the whole story

seem to us to be best explained by the effects of alcohol, an alcoholic's nightmare about toxic mushrooms. Meyrink reveals no knowledge of fungal toxicology. The prolific American writer Percival Wilde in his *Tinsley's Bones*, published in 1942, introduces as a witness a knowledgeable female mycologist who seems to be addicted to mushrooms of the genus Panaeolus as a substitute for cocktails, the author and his character displaying thereby an astonishing command of mushroomic esoterica; but mushrooms in this yarn were not the agent used for the murder.

The facts about lethal mushrooms are to be found, not in standard medical reference works, but in mycological publications. They are well summarized in John Ramsbottom's *A Handbook of the Larger British Fungi*, an indispensable reference book, which however still characterizes *Amanita mappa* as poisonous, ignoring the work done by the French with this species. Good instances of poisoning by the deadly amanitas appear in a Canadian Government publication, *Mushrooms and Toadstools*, by H. T. Güssow and W. S. Odell. Certainly the best worked up case history in any language is the account of the tragic end of a Madame Boyer and her daughter Elodie, more than a century ago, retold with dramatic suspense and pathos by Camille Fauvel in his delightful little book, *Le Champignon qui tue*, published in Paris in 1926. The best single source of information about all the toxic mushrooms is, we believe, *Les Champignons Toxiques et Hallucinogènes*, by Roger Heim, published by Boubée in Paris.

Mycologists are prone to exaggerate the importance of mushroom poisonings in history. In their writings we repeatedly find a list of eminent persons who have died allegedly from eating poisonous mushrooms, a list that they copy from each other without verification. Some-

times we read that Euripides lost his wife and two daughters thus, an assertion unsupported by any ancient text, apparently based on a misreading of Athenaeus. We read that Pope Clement VII—he who is remembered chiefly for his tribulations with Henry VIII of England—was a victim of poisonous mushrooms. This Pontiff died on September 25, 1534. The date falls in the season of the deadly amanita, but the records show that Clement's symptoms first manifested themselves many months earlier, on May 30, and the course of his fluctuating illness from that moment is well documented. We discover in the record no trace of the telltale syndrome. As his biographer Emmanuel Rodocanachi sagely observes, 'In accordance with the custom of those times, people attributed his death to poison.'[1]

Then there was the case of the Holy Roman Emperor Charles VI, father of Maria Theresa of Austria. He had been worried and run down. 'On the 10th [of October 1740] at night his complaint was increased by an indigestion, occasioned by a dish of mushrooms stewed in oil, of which he ate voraciously.' So wrote Archdeacon William Coxe in his *History of the House of Austria.* Ten days later, on October 20, while the doctors were still arguing about the diagnosis, he surprised them by dying. The clinical details that Coxe supplies to us, including the patient's sudden death, are compatible with poisoning by the deadly amanita; we have only to assume that the physicians out of a sense of decorum played down the unpleasant details of his last illness. There were no allegations that the poisoning, if such it was, was deliberate. If fungi were the agent, he is the one important personage in modern times thus killed. His end precipi-

[1] *Histoire de Rome: Les Pontificats d'Adrien VI et de Clément VII*, Librarie Hachette, Paris, 1933. See also Ludwig Pastor, *The History of the Popes*, London, 1910, Vol. 10.

tated war and it is on record that Voltaire declared 'a pot of mushrooms changed the history of Europe'.

Most remarkable is the persistence in mycological writings of the assertion that Tsar Aleksei of Russia or his widow died from mushrooms. Sometimes the texts name him, but more often her. As to the Tsar himself, the circumstances of his death are well known and are unrelated to fungi.

The source of these reports is to be found in a footnote that appears on page 111 of Jean-Jacques Paulet's classic *Traité des Champignons*, published in Paris in 1793, reading as follows:

> L'accident arrivé à la veuve du czar Alexis, qui s'empoisonna avec des champignons qu'on avait gardés pour le carême, et rapporté par Müller, est de notre siècle.
>
> The accident that befell the widow of the Tsar Alexis, who was poisoned by mushrooms that had been set aside for Lent, as reported by Müller, belongs to our century.

Paulet's remark would arouse skepticism in any Russian. In winter (especially during Lent) the Great Russians eat an immense quantity of mushrooms, dried and marinated. The Tsarina would of course have enjoyed the pick of the harvest. Had she been the victim of deliberate poisoning, we should certainly not be indebted for our information about this event to a mycologist writing in France almost a century later. The Russian Court chronicles would have reported the episode and the attendant furore. If a mistake was made (which is almost incredible), everyone who shared in the dish would have succumbed. No one in Russia has ever heard of such a tragedy.

Paulet refers to a book by 'Müller', Vol. II, p. 59. In vain did we look for it, until one day we came across an essay on this very citation by a Russian, B. P. Vasil'kov, the specialist in the higher fungi residing in Leningrad.

His Russian text has never been published, but it was translated out of Russian into Czech and published in *Mykologicky sbornik*, in 1955 (no. 3, pp. 63–65, and no. 4, pp. 97–99), a mushroom journal so obscure that few inside Czechoslovakia see it and only we abroad. It seems that when Paulet refers to 'Müller' he means Friedrich Christian Weber, whose *Das Veränderte Russland* first appeared in Frankfort in 1721, and again in German in 1729 and 1738. An English translation, *The Present State of Russia*, came out in two volumes in 1723, and a French version, also in two volumes, in 1725, entitled *Nouveaux Mémoires sur l'Etat présent de la Grande Russie ou Moscovie.* Some copies of the French edition were wrongly bound, carrying on the title page by mistake the heading of a chapter *Les Moeurs et Usages des Ostyakes*, contributed by Johann Bernhard Müller, a Swedish prisoner-of-war living in Siberia. Endowed with a rare gift of serendipity, B.P. Vasil'kov came across one of the misbound copies in the M.E. Saltykov-Shchedrin Public Library in Leningrad, and there in Volume II, p. 59, was the telltale quotation showing precisely where Paulet had made his mistake. (Vasil'kov was the one man in millions who would grasp the meaning of what he had found.) The French source reads:

> La Czarine Douairière, veuve du feu Czar Alexis, étant morte au Carême de l'année 1715, on ouvrit son corps, & l'on trouva que la principale cause de sa maladie, étoit d'avoir trop mangé de ces champignons marinés, pour observer le jeun plus régulièrement.

In the English text, Vol. I, p. 333, this is the translation:

> The Czarina-Dowager, Relict of the late Czar Alexius, dying in the year 1715, during Lent, her Body was opened, and it was found, that her Indisposition was chiefly occasioned by eating too much of those pickled Mushrooms, out of Devotion of strictly observing her Fast.

So there is no question of poisonous mushrooms,

merely overindulgence in delectable pickled mushrooms. The German author Weber was incapable of understanding the Russian appetite for mushrooms and credits the Tsarina Dowager with an excess of pious zeal! The French mycologist Paulet, with a clear French text before him, was incapable of distinguishing toxic mushrooms from an excessive indulgence in good mushrooms! A long succession of other writers, undoubtedly mycophobes at heart, have accepted Paulet's account without verification, on the mycophobe's rule-of-thumb that nothing bad said about mushrooms can be undeserved.

But the imbroglio does not end here. The German edition, as we said before, first appeared in 1721 in Frankfort. In it Weber had attributed the death from mushrooms, not to the widow of Tsar Aleksei, but to the widow of Ivan V, and this account survived in the later German editions. But the widow of Ivan V was still alive when Weber's book appeared: she died in 1723, not 1715! Quite properly, the English and French translations happily avoided killing off the living Tsarina Dowager, but substituted another by guesswork. As for the widow of the Tsar Aleksei, the mother of Peter the Great, a personage in her own right known to historians as Natalija Kyrilovna Naryshkina, she died in 1694, not 1715. Weber was confused. There remains another possibility suggested by Vasil'kov: The Tsarina Dowager Marfa Matveevna Apraksina, widow of Fëdor III Alekseevich, who in fact died on December 31, 1715, but whom Weber never mentions.

A famous surfeit of lampreys once brought about the death of an English sovereign. It would be singularly fitting, given the Russian addiction to mushrooms, that a surfeit of mushrooms should have precipitated the end of an exalted personage in the Russian Imperial household. On the likelihood that Weber had a specific death

in mind, we choose to think that Marfa Matveevna died of a gluttonous appetite for mushrooms at Christmastide in 1715, the autopsy revealing the cause of her death, that cause supplying History with her only claim on lasting fame.

So much for the famous men and women whose deaths have been attributed rightly or wrongly to mushrooms. This mortuary procession of alleged mushroomic victims would be incomplete if we did not here add the murders revealed by *l'affaire Girard*. In this case the victims were persons of no consequence: their very names are forgotten. But the circumstances that brought them to their deaths are, for mycophiles and epicures of crime, both instructive and fascinating.

The standard mushroom manuals of France, like those of England, have always been saturated with mycophobic caution. By overstating the toxic dangers of various species, they have aimed at assuring the safety of their readers. But, through a strange conjuncture of events, that very bias once contributed to the disastrous end of a man who trusted his mushroom manual too much. Such is the lesson to be learned from this police episode.

Girard's murders would doubtless have drawn wide attention if the press stories had not broken at the precise moment of the great spring offensive of 1918, the final year of the first World War. Girard was a Parisian, and his accomplices were his wife and his mistress. He murdered only his friends, after insuring their lives in his own favor. Poisons were his instrument, and among other poisons he used toadstools gathered for him in the forest of Rambouillet by an old hobo known as le père Théo, whose testimony later was damning to the accused. From time to time Girard would order from Théo a mess of amanitas: they had to have white gills veil, and volva—the stigmata of the deadly amanita, but

also of *Amanita mappa* and *citrina*. Girard and his wife would serve these fungi to their victims at sumptuous dinners in their own apartment. Sometimes the guest went home and after a lingering illness died, but on other occasions, to the surprise and discomfiture of the Girards, the intended victim suffered no ill effects. Indeed, a number of them lived to give their evidence to the police.

In 1918 the standard mushroom manual of France was Paul Dumée's. Like all of the over-cautious manuals of that time, it lumped *Amanita citrina* with the deadly ones. Girard had not thought it necessary, therefore, to distinguish the lethal amanitas when instructing old Théo about the mushrooms to gather. Thus it came about that when Théo brought in a mess of *Amanita phalloides*, the victim would enjoy a dish of tasty mushrooms and later die. But when Théo produced specimens of innocent *A. citrina*, the intended victim must have found them less pleasant to the taste, and that was the end of the matter. For the deadly amanita makes a delectable dish, whereas its relative the innocent citrina scarcely rises palate-wise to the mediocre level.

Thus it may be said that Girard was deceived and misled by Dumée's over-cautious manual, with the result that some of his friends and intended victims unwittingly survived his honest efforts to do them in, and he in turn was fatally entangled in the law's toils. Now that the French manuals have improved, Girard's mistake is unlikely to be repeated. Had Girard hailed from Sérignan, Henri Fabre's village in the Provence, he would have known from childhood not to rely on Dumée, for these peasants need no manuals.

Girard's crimes would have been forgotten, had it not happened that Camille Fauvel, that prodigious mycophile, was a *Commissaire de Police* in Paris at the time,

and though he was not handling the Girard case, having lately been charged with the more famous and important but less interesting Mata Hari dossier, he followed it with expert attention, even interviewing Girard in Fresnes prison after the conviction, in the interests of mycological lore. Fauvel published an admirable narrative of the affair many years later, in the *Supplément* to the issues of June and August, 1936, of the *Revue de Mycologie*, and we have drawn our facts from his account. It should be added that Girard died in his prison bed of tuberculosis a few days after he was interviewed, never having admitted his guilt nor that he had relied on the unsound advice of Dumée. But Fauvel's inference is based upon evidence that leaves little room for doubt.

All that we have set forth in this chapter up to now—the description of the singular properties of lethal mushrooms, the inadequacy of mystery writers when they deal with this theme, our comments on alleged poisonings of eminent personages and the mushroomic murders of unimportant folk—has had only one purpose: to equip the reader for a reconsideration of the death of the Emperor Claudius in A.D. 54. On that occasion, the whole of the Roman Empire and the known world swung on a dish of poisoned mushrooms. The accounts in the ancient writings of that famous event are an old, old story, familiar to all students of antiquity. Those texts have been parsed by students, dissected by historians, pondered by moralists for close on twenty centuries. It would seem that by now every conceivable interpretation must have been hit upon, and the resources of scholarly inquiry exhausted. Indeed, the signs of exhaustion are not lacking: in our own generation Guglielmo Ferraro in his *The Women of the Caesars* has not only struggled to exonerate Agrippina of the dreadful charge laid at her

door, but to portray her as a noble Roman matron!

It would be surprising if at this late date fresh evidence shedding light on Claudius's death were discovered, and yet this is what we think we have done. We rely solely on the same worn texts, and we entrust our fate to the verdict of scholars far more learned than we. Those old texts have a message to deliver to us that can be dissected only by one who is a lover of mushrooms, and above all an amateur of venomy—amateur in the sense of a critical but passive observer of those who have practiced that subtle art.

Let us recall the background of the crime. Claudius succeeded Caligula as emperor in the year 41, at the age of 51. By his third wife, Messalina, he had had a son, Britannicus, born the year before his accession. After executing Messalina for adultery, he married his niece Agrippina, who by a previous marriage had a son of her own, three years senior to Brittanicus; and her son was destined to worldly immortality as the Emperor Nero. Indeed, Agrippina's motive in murdering her husband was to assure the succession to Nero, in which endeavor success crowned her efforts. Claudius at the time of his death was said to be favoring Britannicus, and it was even bruited that he had bequeathed the Empire to Britannicus in a will that Agrippina destroyed.

From A.D. 50 the youth to be known to posterity as Nero had as his tutor Seneca the Elder, and at the time of the crime Seneca was an intimate of the imperial circle, probably privy to all that took place at Court. He could have left us the inside story of what happened, but instead he veils his remarks in satire—the prudent evasion of one who undoubtedly knew too much. Three of the ancient historians have given us accounts of the event. Tacitus, who was born probably in the year after Claudius's death, wrote his narrative about sixty years

later; Suetonius's version came a few years after that; and Dio Cassius told the story again almost two centuries after the event. These three secondary sources differ among themselves in details, which gives to their agreement on essentials a stamp of verisimilitude. In the main they were not copying each other, and they probably had the important facts right.

Claudius was exceedingly fond of the mushrooms known to the Romans as *boleti:* indeed a plausible tradition has it that his favorite kind was what we know today as *Amanita caesarea.* (In antiquity *boleti* meant what mycologists since Linnaeus' day have called the amanitas.) The dish of mushrooms that he ate on the fateful day consisted of *poisoned*, not poisonous mushrooms. On this all three of the ancient historians agree, in different words. None identifies the poison that was used, but they are abundantly clear that poison was added to the Emperor's favorite dish. Here is Tacitus, Book XII, Chap. lxvii of the *Annals* in the Loeb edition:

> Adeoque cuncta mox pernotuere, ut temporum illorum scriptores prodiderint infusum delectabili cibo boleto venenum.
>
> So notorious, later, were the whole proceedings that authors of the period have recorded that the poison was sprinkled on an exceptionally fine mushroom.

Suetonius gives two versions, in Book V, Chap. xliv, in the Loeb edition:

> Et veneno quidem occisum convenit; ubi autem et per quem dato, discrepat. Quidam tradunt epulanti in arce cum sacerdotibus per Halotum spadonem praegustatorem; alii domestico convivio per ipsam Agrippinam, quae boletum medicatum avidissimo ciborum talium optulerat.
>
> That Claudius was poisoned is the general belief, but when it was done and by whom is disputed. Some say that it was his taster, the eunuch Halotus, as he was banqueting on the Citadel with the priests; others that at a family dinner Agrippina served the drug to him with her own hand in mushrooms, a dish of which he was extravagantly fond.

Suetonius places the poisoned mushrooms only in his alternative account, but mushrooms could have been the vehicle that Halotus used too, and this may be implied. Dio Cassius comes down to us in a Greek summary. In Book LXI he accuses Agrippina of having put the poison into 'one of the vegetables called mushrooms', for mushroom the Greek text using the word *μύκης*. A few pages later Dio Cassius refers again to the same poison when he says:

> Agrippina was ever ready to attempt the most daring undertakings: for example, she caused the death of Marcus Junius Silanus, sending him some of the poison with which she had treacherously murdered her husband.

What poison did Agrippina use? This much we know: she turned for advice and aid to a woman named Locusta, an experienced artist in the preparation of poisons, as Dio Cassius puts it. According to Tacitus, the instructions of the Empress to Locusta were narrowly defined. The poison was not to be sudden and instantaneous in its operation, lest the desperate achievement should be discovered. On the other hand, if the effect was slow and consuming, Claudius as his end approached might discover the treachery and take steps to thwart the perpetrators in their ultimate purposes. (He might, that is to say, proclaim Britannicus as his heir.) Something subtle was needed, which would take time but also, at the appointed hour, deprive the victim of his faculties. As Tacitus goes on to say, by Locusta's skill the desired poison was prepared. The passage in the *Annals* of Tacitus being a crux in our argument, we give it in full:

> Tum Agrippina sceleris olim certa et oblatae occasionis propera nec ministrorum egens, de genere veneni consultavit, ne repentino et praecipiti facinus proderetur; si lentum et tabidum delegisset, ne admotus supremis Claudius et dolo intellecto ad amorem filii rediret. Exquisitum aliquid placebat, quod turbaret mentem et mortem differret.

> It was then that Agrippina, long since bent upon the impious deed, and eagerly seizing the present occasion, well furnished too as she was with wicked agents, deliberated upon the nature of the poison she would use, whether, 'if it were sudden and instantaneous in its operation, the desperate achievement would not be brought to light: if she chose materials slow and consuming in their operation, whether Claudius, when his end approached, and perhaps having discovered the treachery, would not resume his affection for his son'. Something of a subtle nature was therefore resolved upon, 'such as would disorder his brain and require time to kill'. [Oxford translation, *Annals*, Book XII, Chap. 66.]

There was only one poison available to the ancients that would fulfill Agrippina's requirements—the poison of the deadly amanita. The victim would not give away the game by any abnormal indisposition at the meal, but when the seizure came, he would be so severely stricken that thereafter he would no longer be in command of his own faculties. For one familiar with the properties of *Amanita phalloides* the text in Tacitus seems transparently clear. The great Roman historian, probably unaware of the meaning behind his words, is revealing the secret of the murderers. But for others than mycophiles there might remain a doubt: is it legitimate for us to infer that Locusta knew the deadly amanita and its secret virtue to which even now, after nineteen centuries, few are privy?

This question troubled and challenged us, not because we were uncertain but because it would be hard to carry conviction with an uninitiated public. Once more we reviewed all the principal sources, all the stray allusions in the classical writers. We concentrated especially on Seneca. After all, he was a witness whose testimony would have been competent in our own courts of justice: he was articulate, and had he not carried the secret etched sharp in his memory from that fateful October day in A.D. 54 until his death eleven years later? Somewhere,

if only by inadvertence, he must have talked, and perhaps his revealing words had survived, their esoteric meaning hitherto unperceived. We embarked on a reading of all his extant writings. We began with his later works, composed after the death of the Emperor, and tried to orient each sentence toward that event. Suddenly one day we came upon the tell-tale phrase: it leaped at us from the page, fairly shouting at us. Yes, surely with sly intention Seneca had imparted the fateful secret to all knowing readers. And before us not a single commentator had ever caught the inner meaning of the simple words.

We refer the reader to Letter XCV that the old Stoic wrote to his friend Lucilius nine or ten years after the death of the Emperor and one or two years before he took his own life on Nero's orders. In it he describes and deplores the excesses of the Roman upper class. He refers to the late Emperor's gluttony:

> Di boni, quantum hominum unus venter exercet! Quid? Tu illos boletos, voluptarium venenum, nihil occulti operis iudicas facere, etiam si praesentanei non fuerunt.
>
> Good gods! What a number of men does one belly employ! But can you think those mushrooms (a tasty poison) do not secretly and gradually operate, though no bad effect is immediately perceived from them? [Loeb translation]

Here is proof that Seneca knew *Amanita phalloides*, that an intimate of Nero's circle was privy to a secret shared by few even today. So far as we know, we are the first to link these lines with the death of Claudius. To us the tell-tale sentence seems to be injected into the letter out of context, as though the writer were blurting out the secret with which he had been living all these years, perhaps blurting it out intentionally, for the benefit of those who could read between his lines.

The period of silent invasion, that *véritable signature* of the lethal mushroom, was familiar to Seneca, and he

even took pains to mention how tasty the wicked mushroom was. How much guilty knowledge packed into a few words! Read in conjunction with the Empress Agrippina's instructions to Locusta, we believe it clinches our case. The poison in the dish of Caesar's amanitas was the poison of the deadly amanita. Two of our authors, Suetonius and Tacitus, give us grounds for supposing that the administration of the poison was entrusted to the eunuch Halotus, whose office it was to taste the Emperor's food before serving it to him. Tacitus says that a person unnamed (presumably Halotus) poured the poison into the dish of mushrooms. It would have been easy for Locusta to prepare a sauce from the deadly specimens, and by enlisting the aid of Halotus, no suspicion would be aroused by the failure to serve it to others at the feast. However, this is a detail, important at the time to the participants of course, but secondary to the primary fact that the ancient writers are telling us exactly how Locusta handled the assignment with which Agrippina charged her. We believe that the secret of those two fearless and wicked women is withheld from us no longer. (Latinists and mycologists will note that Seneca uses the word *boletus* for the deadly amanita: clearly it was the term for all amanitas, not merely *Amanita caesarea.*)

We rest our case on the knowledge shown by Seneca and the quoted passage from Tacitus, taken together. But there is additional circumstantial evidence compatible with our theory. The crime was committed on October 12—in the season when the deadly amanita could be easily found around Rome. On the morrow after Claudius had eaten the mushrooms and while he was yet alive, comedians were introduced into his presence to solace and delight him, as Suetonius says. Since any such kind intention was foreign to Agrippina's nature, and *a for-*

tiori at the dreadful moment that we are considering, we may assume that her purpose was different: the comic actors were to bear witness in the public market-place that the Emperor had not been killed but was in truth desperately ill, and the Hippocratic facies that we know he must have manifested gave them full warranty for such a report. Immediately after Claudius's death, he was proclaimed a god—a posthumous honor for emperors to which Romans were accustomed. Afterwards, when Nero was in secure possession of his imperial office, he was present at a certain banquet where mushrooms were brought in, and someone alluded to the saying common at that time that mushrooms were 'the food of the gods', *cibus deorum*, *θεων βρῶμα*. To this Nero is said to have replied: "True enough: my father was made a god by eating a mushroom." (This story is told by Suetonius, Dio Cassius, and Petrus Patricius.) Nero's remark is clothed with wit if he was referring to the deadly amanita, and not merely to a dish of edible mushrooms that had been poisoned; and Nero was in a position to know.

In spite of Locusta's artistry, we know that her bold stroke was botched, and this leads us to the second part of the crime. The time schedule alone tells us that something went awry. Claudius sat down to his fatal banquet around 2:30 p.m. on October 12. At or shortly after noon the next day he was dead. The lethal amanitas do not kill so quickly. We do not know at what stage in the lengthy banquet he ate his mushrooms, but probably not at the beginning. His seizure could not have taken place before 9 p.m., and probably not before midnight or later, which would mean that his agony lasted only twelve hours. On its face this is impossible. We pointed out earlier that, for a murderer, *Amanita phalloides* labors under one shortcoming: occasionally a victim recovers. Agrippina could not afford this risk, and even if we had

no evidence to support our theory, we might assume that she and Locusta, as their imperial patient lay at their mercy, resorted to direct methods to dispatch him. Fortunately, our texts come to our help.

'The victim of the plot,' says Dio Cassius, 'was carried from the banquet quite overcome by strong drink, a thing that had happened many times before.' Suetonius's version is hesitant: 'Of those accidents which also ensued hereupon [after eating the mushrooms] the report is variable. Some say that straight upon the receipt of the poison he became speechless, and continuing all night in dolorous torments died a little before day. Others affirm that at first he fell asleep, and afterwards, as the meat flowed and floated aloft, vomited all up.' (If it is true that in his usual drunken stupor he threw up, this was enough to send the two women into a panic, for he might have rid himself of the fungal poison; but perhaps the vomiting came later, when the deadly amanitas finally made themselves felt.) Tacitus is explicit: 'Agrippina therefore became dismayed; but as her life was at stake, she thought little of the odium of her present proceedings, and called in the aid of Xenophon the physician, whom she had already implicated in her guilty purposes. It is believed that he, as if he purposed to assist Claudius in his effort to vomit, put down his throat a feather besmeared with deadly poison; not unaware that in desperate villainies the attempt without the deed is perilous, while to insure the reward they must be done effectually at once.' There was thus a second poisoning, with the Greek physician Xenophon replacing Locusta. Suetonius says that, according to one report, the second poisoning was by clyster.

What was that poison to which Xenophon had hurried recourse? Robert Graves in private correspondence offers us an answer that fits the circumstances perfectly. Not

long after Claudius's death, a satire (attributed usually to Seneca) was published on the emperor's deification to which the author gave the title of *Apocolocyntosis*, an artificial word inserting the Greek *colocynthis* into the middle of *apotheosis*. The colocynth (as we call this gourd in English) was the Greek name used in Rome at the time for a gourd recently introduced from the Near East. When the title of the satire is translated the Pumpkinification of Claudius, all its sap is drained out of the name: a 'pumpkin-head' means merely that Claudius was made a dunce of, was 'duncified'. Moreover, the botanist is rendered uncomfortable by an anachronism: the pumpkins and squashes were introduced into Europe in the 15th century, being native to America. The Mediterranean shores knew other cucurbits, but not the pumpkins and squashes. Scholars who use 'pumkinification', miss the point of *Apocolocyntosis*.

The 'colocynth' as used in Rome at that time is not edible. It is exceedingly bitter, whence its name 'the bitter gourd'. It is not native to Italy, but was imported from the arid areas of the Near East, notably Palestine. This is the famous gourd that responded to Elisha's miraculous powers in II Kings, Chapter 4, verses 38–41:

> And Elisha came againe to Gilgal, and there was a dearth in the land, and the sonnes of the Prophets were sitting before him: and hee said unto his seruant, Set on the great pot, and seethe pottage for the sonnes of the Prophets.
>
> And one went out into the field to gather herbes, and found a wild vine, and gathered thereof wilde gourds his lap full, and came and shred them into the pot of pottage: for they knew them not.
>
> So they poured out for the men to eat: and it came to passe as they were eating of the pottage, that they cried out, and said, O thou man of God, there is death in the pot. And they could not eate thereof.
>
> But he said, Then bring meale. And he cast it into the pot: And he said, poure out for the people, that they may eat. And there was no harme in the pot.

In minimal doses the colocynth is a violent purgative; in larger doses it is lethal. It happens that we know the history of this drug in surprising detail. In the first century of the Christian era the upper classes of Rome were much concerned with their health: hypochondriasis was rampant, and miracle drugs were being discovered one after the other.[2] In A.D. 43, when Claudius led a campaign into Britain, one Scribonius Largus was serving as an army surgeon with his forces. Some scholars have assumed that he then rose to the status of the Emperor's private physician and that he was in attendance on Messalina. However this may be, it seems certain that C. Julius Callistus, a freedman who became a powerful favorite of Claudius, encouraged Scribonius to assemble and circulate a book of prescriptions, drawing these writings to the attention of the Emperor. They are the earliest of such writings that have come down to us in Latin literature, and they must have exerted considerable influence on the medical practice of that age. Among them Prescription 106 employs colocynth, which Scribonius called by its Greek name, showing that it was at that time a novelty introduced from the East. It probably enjoyed considerable vogue among the elite and fashionable of Rome in the middle of the first century. In the desperate extremity of that turbulent night of October 12, A.D. 54, when the Greek physician Xenophon was called in consultation and permitted himself to become a *particeps criminis*, it was natural for him to come to the rescue of Locusta and Agrippina by dispatching Claudius with an overdose of colocynth, ad-

[2] Some of the drugs used in imperial Rome have survived in use until recent times. One such is the agaric, and another is colocynth, this latter having been the base for 'general issue' purgative pills in the British army in the first world war. We too, in the mid-20th century, are witnessing a spate of miraculous pharmaceutical discoveries. Will a single one of them be remembered in A.D. 3850?

ministered by mouth or clyster or both. This explains the name that Seneca gave to his satire. Claudius's last words, as attributed to him by Seneca, were: *Vae me! puto concacavi me*—'There now! I say, I have fouled myself!', which would be apt for either colocynth or the deadly amanita.[3]

If then our reading of the text is right, Claudius was done in with a one-two knock-out, first a dose of the deadly amanita, and then a dose of colocynth. As a pun on 'apotheosis', the name of Seneca's satire *Apocolocyntosis* at last becomes clothed with wit: the deification of an emperor is reduced to a repulsive scatological metamorphosis. When, later, Agrippina did away with Marcus Junius Silanus (as Dio Cassius tells us), it was the deadly amanita that she used, and not colocynth: for colocynth proclaims its presence by its bitterness, and an intended victim would spew it out forthwith.

At noon on October 13 the gates of the imperial palace in Rome swung open, and Nero, then a youth of 17, emerged and presented himself as the new emperor to the army detachment that was on guard there. The Emperor Claudius was dead, or *in extremis*. There could have been no reason, only danger, in prolonging the interval between the death of the old emperor and the assumption of authority by the new.

And so we bring our review of Claudius's death to an end. The three ancient historians who tell us the story were not clinicians. Their accounts, differing sharply in the unessential details, give us a surprisingly clear and consistent overall clinical picture. This is circumstantial evidence of virtually conclusive weight that they were telling the truth. They could not severally have invented

[3] For information concerning the early use of colocynth in Rome, the best source is Wilhelm Schonack's scholarly study *Die Rezeptsammlung des Scribonius Largus*, published in Jena in 1912.

a combination of symptoms, and a sequence of events, that two thousand years later would speak for themselves.

Our sources say that a curtain of secrecy had shrouded the palace during the illness of Claudius. It is tempting to try to reconstruct the scenes in the imperial palace before and during the crime. The plot had been laid earlier in whispered conversations between Agrippina and Locusta in some safe spot to which Locusta had been furtively summoned. How stirred Locusta must have been by her great assignment: the world offered none bigger for a person in her line of work. Locusta, if she possessed imagination as well as art, may well have leaped with excitement at the thought that this deed, artfully accomplished, would bring her immortality; and indeed it has done so. But during that fateful night the tension must have been unbearable. Had their victim foiled their efforts prematurely from drunkenness, by vomiting before the poisonous amanita had done its damage? Might he survive and resume the exercise of imperial functions? Was Locusta vexed, her professional pride hurt, when Xenophon was called in, or was she relieved? With what anxious eyes Locusta and Agrippina must have searched each other's ill-lighted faces as the hours crept on! But in any case, with his enemies in command at his bedside, Claudius stood no chance.

The triumph of Agrippina and her fellow conspirators bestowed on them all power. They may well have gloated in their success, and were so situated that they could talk with a large measure of impunity. In the writings of Seneca and the three historians, one seems to hear echoes of veiled boasting, as though Locusta and Agrippina were dying to tell just how they had contrived their ends. Their words were veiled, in homage to virtue, but thinly, and lend themselves to understanding by the initiated, if only across a chasm of nineteen centuries.

DE PLANTIS TOXICARIIS E MUNDO NOVO TROPICALE COMMENTATIONES IX

A NEW SPECIES OF ICHTHYOTOXIC PLANT FROM THE AMAZON

BY

RICHARD EVANS SCHULTES AND JOSÉ CUATRECASAS

The rare bombacaceous genus *Patinoa* was described in 1953 (Cuatrecasas, J.: Rev. Int. Bot. Appl. Agric. Trop. Nos. 369–370 (1953) 309, figs. 1, 2, t. 3, 6–13) on the basis of *P. Almirajo* Cuatr., a species native to the Pacific coastal regions of Colombia: near Quibdó in the Intendencia del Chocó. It is a fruit tree cultivated in rain forested sites and known locally under the name *almirajó*, source of its specific epithet.

At the same time (Cuatrecasas, J.: loc. cit. 312, fig. 3, t. 3, 14), a second species — *Patinoa sphaerocarpa* Cuatr. — was described from the central part of the Brazilian Estado do Amazonas, where the tree is called *cupú*.

In 1902, Jacques Huber (Huber, J.: Bol. Mus. Paraense 3 (1902) 430) described *Matisia paraensis* from the eastern Amazon. Recent studies have indicated that this concept properly belongs in the genus *Patinoa;* and, in 1971, the necessary new combination — *P. paraensis* — was made (Cuatrecasas, J.: Phytologia 20 (1971) 471). This species is now known from a number of localities in the Brazilian Amazon from Belém, at the mouth of the Rio Amazonas, west to the Río Javarí on the Peru-

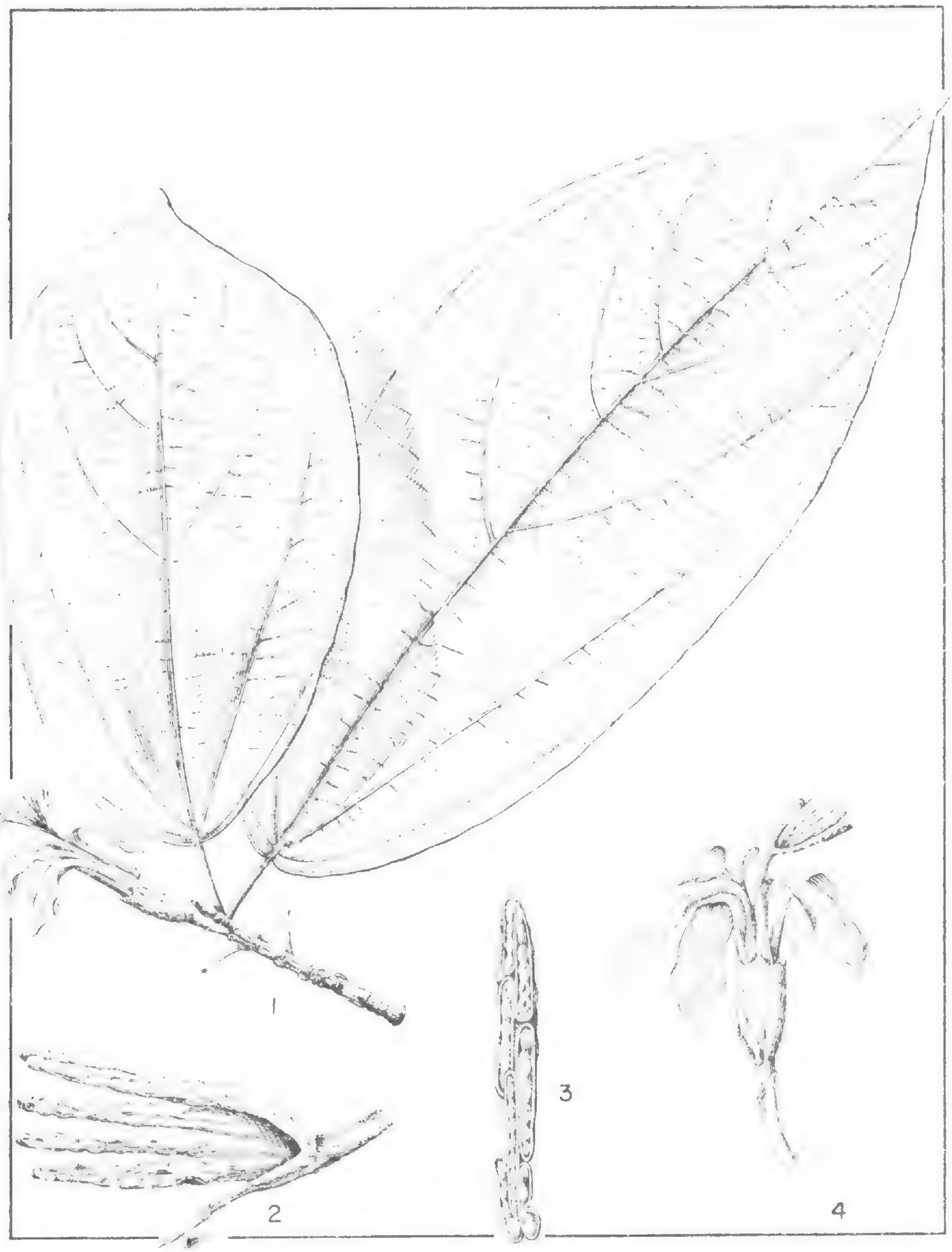
vian frontier. It is known vernacularly as *cupú- rana* or *cupuassú- rana*, an indication that the natives recognize the similarity of this bombacaceous tree to the related sterculiaceous *Theobroma grandiflorum* (Willd. ex Spreng.) Schumann, the *cupuassú* of the Amazon Valley.

The generic concept *Patinoa* is closely akin to *Matisia*, from which it differs primarily in having seeds covered with a thick, lanate tomentum. This wool surrounding the seeds is very conspicuous in the new species described below. In fact, until the fruit was carefully examined, the collections from the type tree were tentatively assigned to the genus *Quararibea* or *Matisia*. Other significant and distinctive characters of *Patinoa* are found in the structure of the stigmas and the pollen grains.

Patinoa ichthyotoxica *R. E. Schultes et Cuatrecasas sp. nov.*

Arbor mediocris usque ad 30 ped. alta, caudice erecto basim versus 25–40 cm. in diametro, ramis subverticillatis, patulis vel decumbentibus, ramulis terminalibus glabris, cinereo-rugoso cum cortice, suberoso, foliorum cicatricibus magnis conspicuis, apicem versus subrubescentibus, foliis aliquid pendulis. Stipulae ovatae, acutae, brunneo-rufescentes, crassiusculae, usque ad 5 mm. longae, vix caducae. Folia simplicia integraque, valde coriacea; petiolus 2–3 cm. longus, subteres, suberassus, apicem et basim versus etiam infra laminam saepe geniculatus, minutissime cinereo-lepidotus; lamina obovato-elliptica vel obovata, basi rotundata vel irregulariter subcordata, apice abrupte acuminata vel cuspidata, leviter marginata, plus minusve 20–36 cm. longa, 8–18 cm. lata, supra atroviridia utrinque glabra et nitida, subtus pallidioria, ut videtur glabra sed copiosis minutissimis squamis inconspicuis aspersis et sparis pilis stellatis circa 0.4 mm. ad

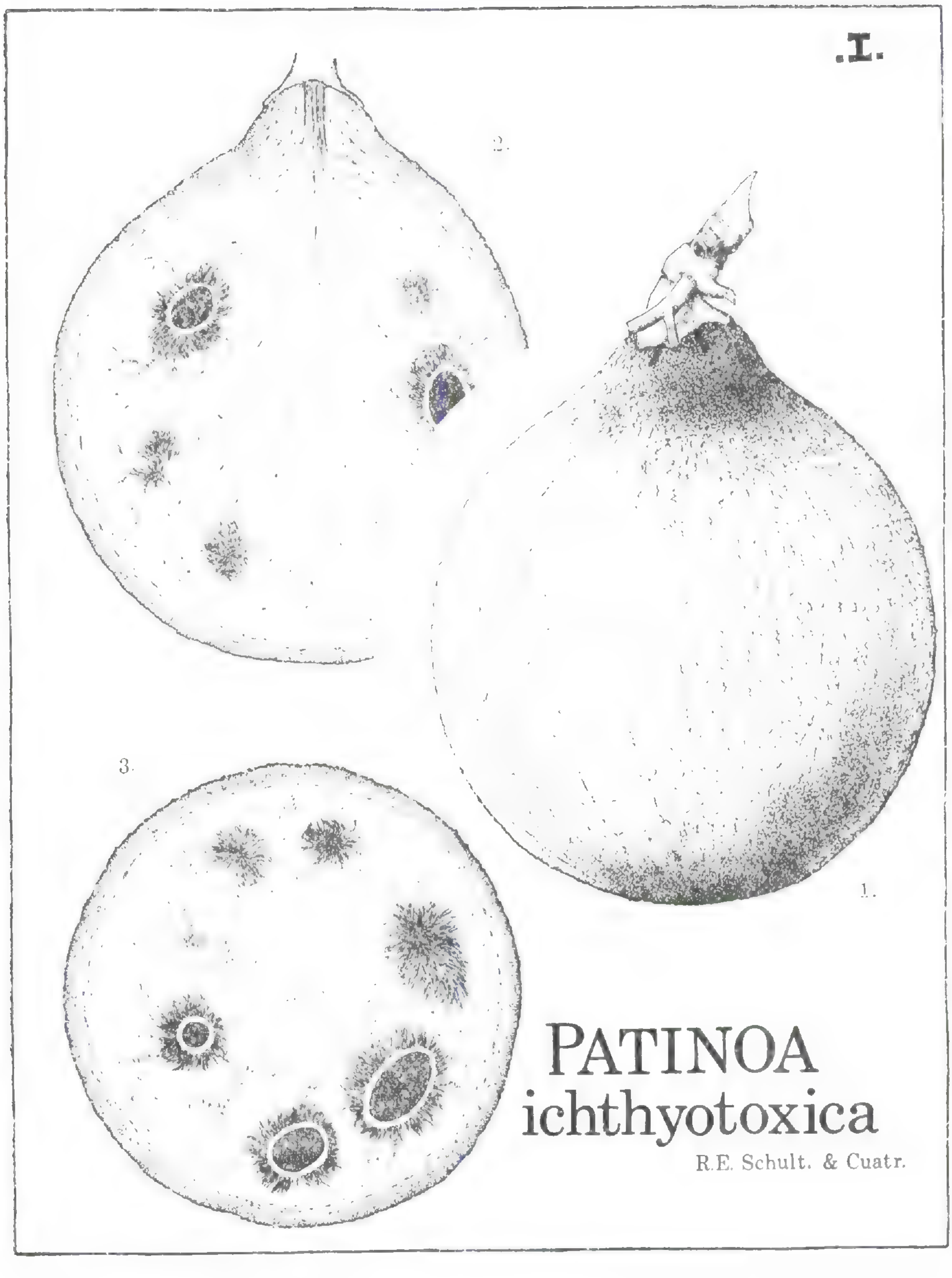
Plate XII



Patinoa ichthyotoxica *R. E. Schult. & Cuatr.* 1, leaves and flower, approximately $\frac{1}{3}$ natural size. 2, terminal part of stamen tube, $2\frac{1}{3}$ times natural size. 3, stamen lobe, approximately 8 times natural size. 4, flower, slightly under $\frac{1}{2}$ natural size. *Drawn by* Joshua B. Clark

nervos principales instructa, basi quintuplinervia, nervis tribus principalibus utrinque prominentibus submarginalibus duobus arcuato-ascendentibus, quattuor nervis secundariis ascendentibus angulo acuto utroque latere e nervi medii orientibus, nervis tertiis transversis subtus prominentibus nervulis minoribus reticulum formantibus. Flos usualiter solitarius (rarenter duo) subterminalis, ad ramusculorum hornotinorum apicem folium oppositus oriens, pedicello crassissimo, rigido, glabro, usque ad 15 mm. longo, 3-4 mm. in diametro, apicem versus duobus cum bracteolis subtriangularibus, obtusis, crassis, 3.5 mm. longis, 4 mm. latis, minute granuloso-lepidotis. Gemma magna, usque ad 30 mm. longa, 10 mm. in diametro. Calyx atrovirens, tubulosus, basi rotundatus, apice inaequaliter breviterque 4–5-dentatus, dentibus latissime triangularibus, ad 1 mm. altis, crassus, ductibus mucilagiferis, extus glaber sed minutissime albido-glandulosus et apicem versus distante albo-stellatus, intus densissime albo-villosus, 20 mm. longus. Petala quinque, aestivatione contorta, crassa, flava sed faucem versus rubra, extus densissime stellata, intus leviter stellato-tomentella, ligulata, abrupte acuta, 80 mm. longa, 13 mm. lata. Stamina in tubum elongatum, crassum, glabrum, plus minusve 55 mm. longum, concrescentia extremo uno latere apertum atque in quinque lacinias antheriferas lineari-ligulata apice subrotundatas, 20 23 mm. longas, 2–2.5 mm. latas productum; laciniis intus laevibus, glabris, extus saccis polliniferis bilocularibus mucilagiferis valde elongatis, 6–9 mm. longis et duo alteris brevibus (supra columnam decurrentibus) longitudinaliter et dense dispositis. Ovarium petagonum subpyramidatum, 6–7 mm. longum, 5 mm. in diametro, villosum, 5-loculare, loculis pluriovulatis, ovalibus anatropis. Stylus subvillosus, parte tubo staminale inclusa filiformi parte libera valde incrassata, striata, apice an-

Plate XIII



Fruit approximately 2/5 natural size. 1, whole fruit. 2, longitudinal section. 3, cross section.

Drawn by Irene Brady

gustata, quinque ramis stigmaticis filiformibus flavis acutis instructus. Fructus globosus, apice non mucronato-acutus, basim versus contractus, superficie laevis, vivo atroviridia, maturitate leviter fulvo-viridis, siccitate flavo-brunneus, omnino densissime minutissimeque chryso-granulosus atque maxime sparsissime albido-pilosus, usque ad 19 cm. longus, 15–16 cm. in diametro; pedunculo 3–4 cm. longo, 1–1.5 cm. crasso; epicarpio subligneso, 3–3.5 mm. crasso; mesocarpio et endocarpio carnosis primum quinque septis instructis deinde in pulpam fibroso-farinaceam albam vertendis. Semina magna, atrobrunnea, irregulariter ovoidea, 2.5–2.8 cm. longa, 2 cm. lata, viginti ad vigintiocto 5-seriata in pulpa involuta; episperme duro, firme coriaceo, 1 mm. crasso, extus pilis crispis intricatis densissimis indumentum lanatum fulvo-brunneum, usque ad 10 mm. crassum formantibus; cotyledonibus rectis, integris, crassis, albidis.

Colombia: Comisaría del Amazonas, Río Amazonas, near mouth of Río Loretoyacu and Puerto Nariño. "Tree 10 m. tall. Hypanthium tube green. Petals fleshy, yellow, red at throat. Anthers yellow. Fruit green, 15 cm. in diameter. In pasture." January 28–February 7, 1969. *T. Plowman, T. Lockwood, H. Kennedy et R.E. Schultes 2317.* (Type in Econ. Herb. Oakes Ames.)—Same locality. "Tree. Sepal tube green. Petals greenish yellow. "September 16, 1963. *D. Soejarto 884.*—Same locality. "Tree 50 feet. Flowers greenish yellow. Alkaloid test on leaves doubtful; bark doubtful." September 13–15, 1966. *R.E. Schultes, R.F. Raffauf et D. Soejarto 24117.*

Patinoa ichthyotoxica differs strikingly from the other three species in its fruit which is very large and nearly perfectly globose. The fruit of *Patinoa paraensis* and *P. Almirajo* are, respectively, ovoid and elliptic-ovoid. In shape, the fruit of this new species resembles that of *Patinoa sphaerocarpa*, but it is much larger and differs in several internal characters. There are also conspicuous differences in shape and indument of floral parts between *Patinoa ichthyotoxica* and the other three species.

As indicated by the specific epithet, *Patinoa ichthyotoxica* possesses fish-stunning properties and is valued by the Tikuna Indians of the Leticia area of the Colombian Amazon as a fish poison. These natives, who know the tree as *tĕ-ha-ra* and the pulp of the fruit as *go-tĕ-har-ra*, collect and dry the abundant fibrous-farinaceous pulp and store it for use during the year. It is not the most commonly employed fish poison among the Tikunas, but it is utilized especially when they make a canoe trip of several days' duration, because it is so easy to carry in a rubberized bag. The crushed, dried pulp is cast out over the surface of small, still inlets or "lagos" where the flow or movement of the imprisoned water is negligible. Within 20 to 30 minutes, small fish float to the surface stunned and are gathered up by the Indians.

Some Tikunas state that the seeds are roasted and eaten, while others insist that it is a dangerous food liable to induce serious diarrhoea and painful intestinal cramps. This disagreement on the part of the natives may be significant. It could reflect differences in preparation of the seeds for eating, but it may have a deeper meaning. The pulp of *Patinoa Almirajo* is commonly used as a food in the Chocó of Colombia, but *P. paraensis* of the Brazilian Amazon has a fruit which is said to be "not edible". (LeCointe, P.: "A Amazonia Brasileira III. Arvores e Plantas Uteis" (1934) 146). This reference may concern the pulp of the fruit instead of the seeds: it is not clear. The seeds of *Patinoa paraensis* are reported (Le Cointe, loc. cit.) to contain 24.6% of a viscous yellow oil which solidifies only at a very low temperature (-15° C).

Patinoa ichthyotoxica is not cultivated. It grows in the dense forests along the river's edge but just above the flood-level. It is common in the *estradas* ("tapping circuits") of *Hevea brasiliensis*, and native rubber tappers

frequently preserve trees encountered in their rubber circuits to gather the fruits for the fish-poisoning pulp. The type tree grows in a pasture, left, at the request of the Indians, when the forest was cleared for cattle raising.

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DE PLANTIS TOXICARIIS E MUNDO NOVO TROPICALE COMMENTATIONES X

NEW DATA ON THE MALPIGHIACEOUS NARCOTICS OF SOUTH AMERICA

BY

RICHARD EVANS SCHULTES

Recent investigations have indicated how much remains to be done to clarify our understanding of the preparation of the South American hallucinogen made basically from the bark of *Banisteriopsis Caapi* (Spr. ex Griseb.) Morton or *B. inebrians* Morton (8, 20, 24).

Although it has been shown that the additive *caapi-pinima* ("painted caapi") of the Tukano Indians of the Rio Uaupes of Brazil was not the apocynaceous *Prestonia* (*Haemadictyon*) *amazonica* (Bth.) Macbride (26), as suggested a century ago by Spruce (27), and accepted widely, even in the chemical literature (11), several members of this family have been reported as admixtures: the crushed leaves of *Malouetia Tamaquarina* A. DeCandolle amongst the Makunas of the Colombian Vaupés (21) and a species of *Tabernaemontana* in Peru (8).

Sundry solanaceous plants are so used. In the Rio Negro-Vaupés region, tobacco (*Nicotiana Tabacum* L.) is often added (2, 14, 21). The Sionas of the Colombian Putumayo employ a Datura, probably *D. suaveolens* Humboldt & Bonpland ex Willdenow (2, 14, 21). A species of Brunfelsia—possibly also taken alone as an hal-

lucinogen—is occasionally added to ayahuasca amongst the Jivaro and other Indians of the westernmost Amazon of Ecuador and Colombia (14, 22).

Some of the additives reported are not known to have biodynamic constituents, and their use may, consequently, be attributed to symbolic reasons. Two amaranthaceous plants of the Colombian Putumayo fall into this category: *Alternanthera Lehmanii* Hieron. (2, 9, 21) and a species of Iresine (21).

Very recent research—perhaps the most extensive on the components of ayahuasca in one geographical area—have discovered a number of curious admixtures amongst the Kulina and Sharanahua of Amazonian Peru (19). In addition to Psychotria (discussed below), the list includes several ferns: *Lygodium venustum* Sw. and *Lomariopsis japurensis* (Mart.) J.Sm.; as well as the loranthaceous *Phygilanthus eugenioides* Eichler, the labiate *Ocimum micranthum* Willdenow, Epiphyllum sp. and Opuntia sp. of the Cactaceae, the cyperaceous Cyperus sp., a member of the guttiferous genus Clusia and two other plants of which the voucher specimens could not be determined.

Perhaps the most significant discoveries relate to the use as additives of leaves of *Banisteriopsis Rusbyana* (Ndz.) Morton, the *oco-yajé* of the westernmost Amazon (2, 6, 14) and leaves of several species of Psychotria, especially of *P. viridis* and *P. carthaginensis* Jacquin in sundry widely separated areas of the Amazon (13, 14, 16, 19, 20, 22). The use of the leaves of these plants is significant mainly from the chemical point of view. The drink called variously *ayahuasca, caapi, natema, pinde* or *yajé*, prepared from the bark of *Banisteriopsis Caapi* or *B. inebrians*, contains the β-carboline alkaloids harmine, harmaline and tetrahydroharmine (20). The leaves of *Banisteriopsis Rusbyana* contain N-N,dimethyltrypta-

mine, the first malpighiaceous species from which a tryptamine has been isolated (1, 6, 15). Similarly, the leaves of *Psychotria viridis* and *P. carthaginensis* (7, 20) have been found to contain the same tryptamine—again the first known occurrence of tryptamines in the family Rubiaceae. Obviously, the addition of leaves of these plants—as the addition of solanaceous plants with tropane alkaloids—greatly heightens the narcotic effects of the drink. That the utilization of *Psychotria* leaves is widespread has been shown by the recent discovery of this custom in the westernmost Amazon in Ecuador and Colombia, in several isolated localities in Amazonian Peru and in the southwestern Amazon of Brazil (7, 13, 14, 16, 17, 20, 22).

In pursuit of our studies of additives or possible additives to ayahuasca, the following voucher specimens authenticating new data are offered.

Teliostachya lanceolata *Nees* var. **crispa** *Nees ex Martius* Fl. Bras. 9 (1847) 72.

Peru: Departamento de Loreto, Iquitos and vicinity. "Cultivated. Flowers white with violet. *Toé negra.*" July 15, 1967. *R. Martin, T. Plowman et* C. *Lau-Cam 1638* [Det. Plowman].

This variety of the acanthaceous *Teliostachya lanceolata* is added to ayahuasca and may be used alone also as a narcotic. The collectors received the following data from a Kokama Indian informant: "1) Used as an admixture to ayahuasca (*Banisteriopsis Caapi*). Two branches are cooked with ayahuasca for about 11 hours. 2) When taken alone, about 10 leaves are cooked gently for 7 hours. The effects (on the mind) last for three days, during which one converses with the spirit of the plant. Also causes loss of sight for three days."

Chemical studies have apparently not been carried out on Teliostachya (10). In view, however, of the suspected

presence in the acanthaceous genus Justicia, source of an admixture to Virola-snuff (25) and reported to be itself the source of an hallucinogenic snuff (4), phytochemical examination of these ethnobotanical field notes might seem to be fully warranted.

It is interesting that this plant is called *toé negra*, since *toé* or *toá* is the Peruvian name of the hallucinogenic *Datura suaveolens*.

Psychotria carthaginensis *Jacquin* Enum. Pl. Carib (1762) 16.

PERU: Departamento de Loreto, Río Nanay, Samito. Alt. ca. 100 m. Forest. "Shrub 2 m. tall. Infl. axis light green. Fr. dark green. Use: the leaf is used in combination with ayahuasca. N. v. *sameruca*." February 20, 1969. *T. Plowman 2528*.

Juanulloa ochracea *Cuatrecasas* in Brittonia 10 (1958) 148.

COLOMBIA: Comisaría del Caquetá, Río Caquetá. Secondary forest near Floresta, ca. 15 km. downstream from Puerto Limón. "Climbing epiphytic shrub on fallen tree, 3 m. tall. Calyx red, corolla yellow; leaves coriaceous. Trunk and leaves used for wounds. V. n. *ayahuasca* (Inga)." December 20, 1968. *T. Plowman 2176*.

The application to the solanaceous *Juanulloa ochracea* of the name *ayahuasca* may indicate that it represents either a species employed directly as the source of a narcotic or one of the additives to the ayahuasca drink. There is, of course, a chemical basis for this belief. The alkaloid parquine, isolated from a member of the solanaceous genus Cestrum, has been reported from a species of Juanulloa (18).

Calathea Veitchiana *Veitch ex Hooker fil.* Bot. Mag. (1865) t. 5535.

PERU: Departamento de Loreto, Río Nanay. Chiriara. "Herb 1.2 m. tall in forest. Leaf dark green above with lt. green markings along midrib and margin; reddish purple beneath; pulvinus pale

greenish brown. Peduncle reddish; floral bracts pale green above, red beneath. Fls. white (?). Use: mixed with ayahuasca to see visions.'' February 28, 1959. *T. Plowman (with F. Tina) 2572.*

No biodynamic constituent is known from the Marantheaceous *Calathea Veitchiana* (10).

Pontederia cordata *Linnaeus* Sp. Pl. (1753) 288.

Colombia: Comisaría del Putumayo, Mocoa. Camino de Herradura Antiguo y Río Rumiyaco. Alt. 700–850 m. ''N. v. *amarón borracheró.* Planta aquática. Flores blancas. Se usa para quitar parálisis fasciales.'' October 10, 1965. *H. García-Barriga, Y. Hashimoto et M. Ishikawa 18685.*

The vernacular name *amarón borrachero* suggests that *Pontederia cordata* either possesses intoxicating principles or is employed as an additive to a narcotic preparation made basically from another plant. The principal narcotic employed in the area of the collection is the drink prepared from *Banisteriopsis inebrians.* In view of the probable lack of toxic principles in this species (10), its use as a symbolic additive is the more likely of the possibilities.

It has long been known that natives in the Amazon area recognize different age forms or ecological forms of plants as ''different kinds'' of the same species. They even ascribe to these ''different kinds'' of plants a variety of biological effects. There may well be different chemical composition—at different ages or stages of growth—we do not know. At any rate, the Indians do definitely ascribe different strengths or intensities of effect to their ''different kinds'' of the same species. This curious treatment according to age forms or stages of growth is especially well recognized in native classifications of the caapi or yagé plant.

Mr. Stephen Hugh-Jones of King's College, Cambridge, spent many months amongst the Barasanas of

the Río Piraparaná of the Colombian Comisaría del Vaupés. An anthropologist, he collected a number of Barasana "varieties" of kahi or yagé. With the exception of one collection, these specimens all appear to be referable to *Banisteriopsis inebrians*. They have been identified by Mr. T. Plowman and checked by the author. The collection is ethnobotanically very significant, even though all of the specimens are in sterile condition.

In a letter dated January 1, 1971, Hugh-Jones wrote: "I had hoped to collect a complete collection of the varieties of Banisteriopsis with enough material for you to do chemical analysis, etc., but didn't. My chief informant, a Barasana shaman, taught me well but very much on his own terms. He was happy to tell me all I wanted to know about yagé, etc., but hated the idea of my collecting specimens and consistently refused to let me. At dusk on my last night in the field he suddenly offered to go with me to get leaf-only samples of yagé —it is this that I send you. . . . The specimens are thin and few, as I was only allowed to take a bit of each.

"There are eight varieties of yagé represented—the Indians in the immediate area recognize about 10 varieties, so the collection is not quite complete. . . . All I have done is to give you the names of the different varieties with their approximate English translations."

Banisteriopsis inebrians *Morton* in Journ. Wash. Acad. Sci. 21 (1931) 485.

COLOMBIA: Comisaría del Vaupés, Río Piraparaná. "Barasana name: *Kahi-ukó* (yageé catalyst)." 1970. *S. Hugh-Jones 3*.—Same locality. "Barasana name: *wai-buku-lihoa-ma* (game animal head yagé)." 1970. *S. Hugh-Jones 4*.—Same locality. "Barasana name: *wenanduri-guda-hubea-ma* (the yagé that came inside the jurupary instrument called *wenanduri*)." *S. Hugh-Jones 5*.—Same locality. Barasana name: *wai-huhua-guda-hubea-ma* (yagé which came inside the jurupary 'fish swim bladder'). Used during 'dance house' ceremony. One sees *people* under the influence." 1970. *S. Hugh-Jones 6*.—Same locality. "Bara-

sana name: *yaiya-s̃uava-kahi-ma* (red jaguar yagé). One sees red under the influence, used during fruit-blowing ceremonies." 1970. *S. Hugh-Jones 7*.—Same locality. "Barasana name: *s̃uari-tukuro-kahi-ma* (red ground yagé). Again one sees red, used during fruit-blowing. 1970. *S. Hugh-Jones 8*.—Same locality. "Barasana name: *hẽ-kahi-ma* (jurupary yagé); *kumua-basere-kahi-ma* (yagé for shamanizing)." 1970. *S. Hugh-Jones 1*.

The following collection, insofar as is possible to determine sterile material on characters proposed by Cuatrecasas, would appear to be referable to:

Banisteriopsis Rusbyana (*Ndz.*) *Morton* in Journ. Wash. Acad Sci. 21 (1931) 487.

Same locality. "Barasana names: *mené-kahi-ma*, *nyoko-buku-guda-hubea-ma* (Inga yagé, the vine which came inside the jurupary instrument called 'old star')." 1970. *S. Hugh-Jones 2* [Det. Plowman].

That there remains much to do in connection with the identification of "different kinds" of caapi and with additives is clearly indicated by the following data concerning still unidentified "kinds" of caapi and additives known only through Indian names.

Brüzzi has indicated that caapi amongst the Tukano of the Brazilian course of the Rio Vaupés may be made from the bark of the following vines (3): *mērē-oē-kaxpi-dá* (inga vine), *boxká-dá* (vine of the forest, of which there are two kinds), *kúri-kaxpi-dá* (a noded vine, giving the strongest caapi drink), *sêi-pixkōrō-dá* (monkey-tail vine), *yché-ñōxkã-dá* (heron-foot vine). None of these vines has been identified by means of botanical material, but it is probable that all may be growth stages of *Banisteriopsis Caapi*, unless, as has been suggested, the third kind—*kúri-kaxpi-dá*—may because of its noded stem, be referred to *Gnetum nodiflorum* Brogniart or *G. Leyboldii* Tula, very common elements of the riverside

vegetation of the Vaupés area, albeit plants not known to possess biodynamic principles.

These same Tukano Indians of Brazil use as additives the crushed leaves of *kaxpi-pūrī* and *kãna-pūrī* as well as the leaves of *doxké-mo-rērī-dá* and *duxtú-sarẽnõ-dá* (3). In addition to the foregoing vines, the Tarianos of the Colombian Vaupés employ as admixtures three "kinds" of the plant called *ma-kaxpi-dá* which is said to make the drink "more virulent". None of these plants is as yet determined botanically on the basis of voucher specimens.

According to the anthropologist, Dr. Gerardo Reichel-Dolmatoff (letter to R.E. Schultes dated November 15, 1971), the Tukano of the Colombian course of the Río Vaupés have what may be even other "kinds" of caapi. *Yai-gahpí* (fish caapi) is a leafy vine with small flowers, said to resemble those of coffee, straight stems without nodules and thin, smooth bark. Another "kind"—*muchípu-gahpí-dá* sun caapi)—is reported to be a "leafy vine with small leaves", with leaves rather violin-shaped or strongly constricted in the middle. Botanical material on which to base identifications is not available.

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ON THE SYSTEMATICS OF THE MONOPODIAL ORCHIDS I.

BY

LESLIE A. GARAY

"Am Ende sind die meisten neueren Gattungen durch Willkür des Systematikers aufgestellt wirklich 'natürliche' sind bei den Orchideen nicht häufig."
—Reichenbach Filius, Linnaea 22: 851, May 1850.*

These seemingly convicting lines must have been written by Reichenbach in the same frustrated state of mind as we find ourselves ever so often while attempting to present a satisfactory circumscription of orchid genera, especially those characterized by a monopodial habit of growth. The monopodial habit in the orchid family has developed independently more than once during its evolutionary history: however, as a recognizable systematic unit, which simultaneously denotes a distinct anagenetic line, has occurred only once and only within the *Vandeae*.

There are no fewer than 206 generic names and some 5,400 binomials pertaining to the monopodial orchids mentioned in the literature to date; of these approximately 50% have been relegated to synonymy. The plants referable to the various genera and species are all native to the tropics and subtropics of both the Old and New Worlds.

*"At the end most of the new genera are established through the arbitrary action of the systematists, truly 'natural' genera are rare in the Orchidaceae."

Ever since Lindley established *Vandeae* as a distinct division of the *Orchidaceae* in 1826, the new genera assigned to this tribe have increased at about the same rate as did the new species which were indiscriminately added to the formerly described genera, until the limit of their circumscriptions became utterly vague and often mutually inclusive. Thus, we find that Hooker in his Flora of British India united *Pteroceras*, *Stereochilus*, *Microptera* and *Chiloschista* with the genus *Sarcochilus*, creating one of the most heterogenous mish-mash for an orchid genus. Also *Saccolabium* has fared equally well; it has received *Schoenorchis*, *Gastrochilus*, *Uncifera* and *Acampe*. In 1905, J.J. Smith extended the ever-widening generic boundary of *Saccolabium* by adding *Omoea* to it together with three new sections to accommodate the additional aberrant types. Ridley, notwithstanding his statement that "The whole of this group of Sarcantheae, ... require to be completely rearranged, and I think more equitably broken up", carried this expansion of *Saccolabium* beyond a perceivable horizon, in 1907, through the inclusion of *Sarcanthus* and *Cleisostoma*. Concurrently with these activities certain *Angraecum* species from Africa have also been referred to *Saccolabium*. Similarly chaotic treatments were extended on the one hand to the Asiatic genera, *Sarcanthus*, *Thrixspermum* and *Vanda*, and on the other hand to the African genera, *Angraecum*, *Aërangis*, *Listrostachys* and *Mystacidium*.

To remedy this deplorable situation, in 1912, J.J. Smith has undertaken to clarify some of the Malaysian genera, especially *Sarcanthus*, *Camarotis*, *Schoenorchis*, *Pomatocalpa*, *Robiquetia*, *Arachnis* and *Vandopsis*. To these he added *Saccolabium* in 1914. Concurrently Schlechter in Die Orchidaceen von Deutsch-Neu-Guinea discussed the details of many of the smaller genera. In 1918, Schlechter also published a revision of all of the

angraecoid orchids of Africa, as well as in 1926 his system of orchids in which he assembled and arranged all genera according to his interpretation of their phyletic affinities. Since that time the only noteworthy contribution to monopodial orchids was by Dockrill who, in 1967, published the results of his investigations on the sarcanthine orchids occurring in Australia. It should be noted that none of the genera and species native to the mainland of Asia and India have been studied and brought into line with the others except those from Thailand by Seidenfaden, who has recently published some extremely valuable data.

Systematic Trends

No other group of orchids representing a distinct anagenetic line can be compared with the monopodials regarding the overwhelming diversity found both at the specific and generic levels. This group is one of the youngest branches in the family, and I believe it is still in a rapidly expanding evolutionary flux. Since in the orchid family reproductive isolation is achieved primarily by other methods than genetic incompatibility, the characterization of species and genera must be extrapolated from the available morphological data. It was Lindley, while preparing his Genera and Species of Orchidaceous Plants, who recognized the fact that the generic criteria in this branch of the family are located primarily in the flowers, especially in the construction of the lip with the position of its callosities and excrescences. Their patterns he observed through longitudinal sections. The reliance upon such seemingly trivial characters, or rather the lack of understanding of them, was the primary cause that has contributed to the systematic chaos in this group which has been partially described above. Yet the significance of such minutiae, as described

by Lindley between 1830 and 1840, only now begins to penetrate our comprehension in the light of the recent advances in anthecology. Although anthecology has its beginning with Kölreuter in 1761, its role in population dynamics has been recognized only during the past 50 years; its importance in systematic biology only now is starting to emerge. The "lynx-eyed" Lindley, as Reichenbach used to call him, was indeed much ahead of his time, for the pollinating mechanisms in the monopodial orchids are deeply anchored in the inner construction of the nectariferous lips. Actual field data on pollinators and pollination, however, are still wanting in this branch of the orchid family.

Regarding the systematic arrangements of the genera, Bentham emphasized a dichotomy through the recognition of the presence of a column-foot or the absence of it, a distinction also upheld by Schlechter. This criterion, however, as shown by Summerhayes and Holttum, is applicable only to extreme situations. As a matter of fact, in several instances, as in *Omoea*, *Papillilabium*, and *Dunstervillea*, it is quite impossible to state with accuracy whether the column is produced in a long foot and the sides of the lip adnate to it or the column is footless with a long-spurred lip adnate to it without articulation. At the same time in *Rhynchostylis* we find both types of column, *i.e.*, with a foot and without a foot: the latter type has been elevated by Schlechter to a distinct genus, *Anota*, which he placed in his system far removed from its natural relationships. Because of these and similar inadequacies, both J.J. Smith and Holttum shifted the emphasis to the number and structure of pollinia in denoting phyletic lines. In that Holttum recognizes four possible conditions: 1, two pollinia, each slightly cleft; 2, four pollinia in two pairs, the members of a pair fitting together and looking like one; 3, four

equal separate pollinia; and 4, two undivided pollinia. Most of the genera in this scheme fall within the first two categories, each forming a distinct line parallel with the other. At the end of each line are those genera which are characterized by either two entire pollinia or four equal pollinia. It is indeed quite revolutionary to derive, as Holttum did, the monopodial orchids from such sympodial ancestors which are also characterized by two notched pollinia and then terminating that line by four equal pollinia, when it has been repeatedly demonstrated that the two-pollinia stage is a derived condition through reduction from the less specialized 8 pollinia per anther. The emphasis on four pollinia in two pairs or on two pollinia, each consisting of a cleft pair, is more semantics than evolutionary reality. This has contributed on several occasions to false claims in relationships.

The four distinct categories mentioned by Holttum apply only to the Asiatic monopodial orchids where the pollinia are attached to a single, common stipe. Although he refers *Angraecum* and its related genera to the group characterized by two notched pollinia (and considers them as a primitive group because of their simple, unadorned lip), the angraecoid orchids clearly show advanced specialization; in most cases each of the pollinia are attached to separate stipes which share a common viscidium or each are attached to separate viscidia. In highly evolved cases the stipe may be completely eliminated through further reduction. The phenomenon of reduction is a dominating force in the whole orchid family and it can manifest itself independently or in conjunction with other evolutionary trends, causing only one or simultaneously several expressions in the phenotype. Probably cognizant of these possibilities, Summerhayes has seen it advisable to separate the angraecoid orchids into a distinct line based on characters which are quite

different from those envisioned by Holttum. He recognizes two subtribes, *Angraecinae* with a deeply excised or cleft clinandrium and an abbreviated rostellum, and *Aërangidinae* with an entire clinandrium and a prominent rostellum.

Evaluation of Generic Criteria

Disturbed as well as intrigued by the available information, especially the misrepresentation and inconsistentcy of them, several years ago I initiated a study toward the delimitation of the genera in the monopodial orchids with the intention of presenting a key to them. In order to secure the correct interpretation of criteria for each genus, it became necessary to typify every generic name as a starting point. With 136 currently recognized genera and approximately 2150 species assigned to them, the task appears to be an endless chore with the end not yet in sight. Having studied literally hundreds of type specimens, the length of the list of incorrectly placed taxa has already outgrown the average length of papers normally printed in periodicals. Consequently this study has to be published in parts, the first of which deals only with those genera where nomenclatorial changes are necessary. Such genera are typified and their salient features are given. Emphasis is placed on the floral structures, since the vegetative aspects are characteristic for the entire phyletic line. The position and size of the column including its parts and accessory organs, such as the various wings, arms, foot-like extensions, clinandrium, rostellum and stigma, present a large series of patterns. The number of pollinia, excluding the semantical interpretation of two in four or four in two, is definitely a weighty character. The insertion of the petals and the lateral sepals is likewise an important criterion. In many instances, of course, the clearest

guide-line for generic delimitation is to be found in the inner structure of the lip.

Every systematic study yields surprising information. Old generic names long in synonymy have to be resurrected, for some wrongly placed species new genera have to be established, while the fate of those "aberrant types" is postponed until the last paragraph has been written on the subject. The generic names *Sarcanthus* and *Camarotis* have to give room to *Cleisostoma* and *Micropera* because of illegitimacy and priority respectively. *Ascochilus*, *Grosourdya* and *Cleisomeria* after typification can again stand among recognized genera, while *Cryptopylos*, *Porrorhachis* and *Sarcophyton* together with a few others are proposed for the first time to accommodate species in genera with characters of their own.

In the following commentaries the genera are arranged alphabetically for an easy reference. A systematic arrangement of all genera according to their probable phyletic affinities together with a key to facilitate identification will comprise the final paper in this series.

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Commentaries on Genera

Adenoncos Bl., Bijdr. 6: t. 2, June 1825.
Type: *Adenoncos virens* Bl.

Characterized by the short, footless column to which the sessile, spurless lip is firmly adnate. Pollinia are distinctly 4, free from one another on a prominent stipe.

Podochilopsis Guillaum. is referable here, and the type species, *P. dalatensis* Guillaum., is identical with *Adenoncos vesiculosa* Carr.

Saccolabium adenoncoides Ridl. is closely related to *A. parviflora* Ridl.

Adenoncos adenoncoides (Ridl.) Garay, *comb. nov.*
Basionym: *Saccolabium adenoncoides* Ridl. in Journ. Str. Br. Roy. As. Soc. 54: 53, 1909.

Aërangis Reichb.f. in Flora 48: 190, Apr. 27, 1865.
Type: *Aërangis flabellifolia* Rchb.f.

Characterized by a short column which is somewhat dilated toward the base; rostellum simple and elongate. Pollinia 2, on a single, elongate stipe. Sepals and petals spreading to reflexed; lip reflexed with the blade much shorter than the slender spur.

Angraecum hyaloides Rchb.f. and *Angraecum crypto-*

don Rchb.f., both of which were referred to this genus by Schlechter, need further study.

Aërangis alcicornis (Rchb.f.) Garay, *comb. nov.*
Basionym: *Angraecum alcicorne* Rchb.f., Otia Bot. Hamb. pt. 2: 117, 1881.

Aërangis campyloplectron (Rchb.f.) Garay, *comb. nov.*
Basionym: *Angraecum campyloplectron* Rchb.f. in Bonpl. 3: 226, 1855.

Aërangis Carusiana (Severino) Garay, *comb. nov.*
Basionym: *Angraecum Carusianum* Severino in Bull. Soc. Tosc. Ortic. 41: 56, fig. 2, 1916.

Aërangis erythrurum (Krzl.) Garay, *comb. nov.*
Basionym: *Angraecum erythrurum* Krzl. in Vierteljahrsch. Naturf. Ges. Zürich, 74: 109, 1929.

Aërangis pallida (S. Wats.) Garay, *comb. nov.*
Basionym: *Angraecum pallidum* S. Wats. in Gard. & Forest 3: 78, 1890.

Aëranthes Lindl. in Bot. Reg. 10: t. 817, Aug. 1, 1824.

Type: *Aeranthes grandiflora* Lindl.

Characterized by the short, emarginate column which is somewhat dilated toward the base; rostellum very short. Pollinia 2, each porate and attached to one gland. Lip in right angle with column with the spur horizontally projecting. Lateral sepals are decurrent on the sides of the lip. The floral structure, especially the lip with its forward-projecting spur is reminiscent of certain *Aerides* species and of *Kingidium taeniale* (Lindl.) P.F. Hunt.

Aëranthes setiformis Garay, *nom. nov.*
Basionym: *Aëranthes pusilla* Schltr. in Fedde Rep. Beih. 33: 282, 1925, not Rchb.f., 1867.

Aëranthes subramosa Garay, *nom. nov.*
Basionym: *Aëranthes gracilis* Schltr. in Fedde Rep. Beih. 33: 277, 1925, not Rchb.f., 1867.

Aerides Lour., Fl. Cochinch. 2: 525, 1790.
Type: *Aerides odorata* Lour.

Characterized by the presence of a distinct column-foot on which the lateral sepals are decurrent; rostellum well-developed, porrect. Pollinia 2, unequally cleft on a single, rather slender stipe. The 3-lobed lip is continuous with the column-foot with a porrect or arrect spur which is variously ornamented inside.

The whole section *Phalaenidium* Pfitz. to which also *Thrixspermum Sillemianum* belongs, as suggested by Pfitzer, needs further study. The rather distantly placed terete leaves on a slender stem, the abbreviated, 1- to 3-flowered racemes with conspicuously large flowers make a very distinct appearance. Pending further investigation, it is probable that this whole section will ultimately be united with the genus *Papilionanthe* which Schlechter justly removed from *Vanda*.

Aerides mitrata is the type of a genus of its own, *Seidenfadenia* Garay.

Micropera viridiflora is related to *Aerides japonica* Rchb.f. and has nothing in common with the genus *Gastrochilus* to which it has been referred lately.

Aerides flabellata must be rigidly compared with *Vanda parviflora* Lindl. and *Vanda testacea* (Lindl.) Rchb.f. for its correct generic position.

Aerides Dalzelliana (Santap.) Garay, *comb. nov.*

Basionym: *Micropera viridiflora* Dalzell in Hook. Journ. Bot. 3: 282, 1841, not *Aerides viridiflora* Thw.

Syn.: *Saccolabium viridiflorum* (Dalzell) Lindl. in Journ. Linn. Soc. 3: 36, 1858.

Gastrochilus viridiflorus (Dalzell) O.Ktze., Rev. Gen. Pl. 2: 661, 1891.

Sarcochilus Dalzellianus Santap. in Kew Bull. 3: 498, 1949.

Gastrochilus Dalzellianus (Santap.) Santap. & Kapadia in Journ. Bombay Nat. Hist. 59: 842, 1962.

Aerides Sillemiana (Rchb.f. Garay, *comb. nov.*
Basionym: *Thrixspermum Sillemianum* Rchb.f. in Gard. Chron. n.s. 17: 524, 1882.

Amesiella Schltr. ex Garay, *gen. nov.*

Type: *Angraecum philippinense* Ames

Etymology: In honor of Prof. Oakes Ames (1874-1950), founder of the Orchid Herbarium of Oakes Ames of Harvard University.

The Philippine orchid flora is well known today because of the works of Oakes Ames. According to the correspondence preserved in the archives of the Orchid Herbarium, Schlechter planned to describe *Amesiella*, based on *Angraecum philippinense*, but his untimely death prevented him from doing so. However, *Amesiella* was published post mortem as a *nomen* in Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 9: 591, no. 567, 1926. With great satisfaction I correct this long-overdue recognition.

Sepala petalaque similia, patentia, speciosa. Sepala lateralia pedem columnae adnata. Labellum sub pede columnae insertum, trilobum, longe angusteque calcaratum. Columna teres, erecta, puberula, basi in pedem distinctum, apice liberum producta; stigma maximum, orbiculare; clinandrium humile; rostellum valde productum, 3-lobum; pollinia 2, integra, ut plurimum breviter incisa stipiti oblongo-lineari affixa, glandula suborbiculari.

Herbae epiphyticae; caulibus abbreviatis, distiche dense foliosis; foliis carnosis, distichis; inflorescentiis breviter pedunculatis, supra racemosis, paucifloris: bracteis rigidis, conduplicato-cymbiformibus; floribus pedicellatis, magnis, albis.

This new genus is related to *Holcoglossum*, differing in having a distinct column-foot with a free apex and

having a prominent, 3-lobed rostellum. In general appearance as well as in the shape of the rostellum it is reminiscent of the African *Mystacidium*, but that genus is characterized among others by two separate caudicle-like stipes, each with its own gland.

The hygrometric behavior of the stipe of *Amesiella* has not been noted previously. The stipe shortly after removal doubles upon itself so that the large bodies of the pollinia are literally resting on the viscidium. I have noted this behavior also in *Holcoglossum*. For fresh material of *Amesiella* I wish to express my appreciation to Mr. Robert Scully, Jones & Scully, Inc., Miami, Florida.

Amesiella philippinensis (Ames) Garay, *comb. nov.*

Basionym: *Angraecum philippinense* Ames in Phil. Journ. Sci. 2: 336, 1907.

Angraecum Bory, Voy. 1: 359, Sept. 1804.

Type: *Angraecum eburneum* Bory

Characterized by a short column with an abbreviated rostellum and deeply cleft clinandrium. Pollinia 2, on separate stipes or directly attached to separate viscidia, rarely on partially united stipe. Lip entire with sides enveloping column, basally produced in a spur without adornments.

Angraecum bracteosum Balf. & S. Moore, *A. coriaceum* (Sw.) Schltr., *A. distichophyllum* A. Rich. ex Finet and *A. striatum* Thou. should be excluded from the genus *Angraecum*. The generic name *Monixus* Finet is available for this group of plants for it is lectotypified by *Angraecum striatum* Thou.

Angraecum linearifolium Garay, *nom. nov.*

Basionym: *Angraecum palmiforme* H. Perr. in Mem. Inst. Sci. Madag. ser. B, 6: 268, 1955, not Thou. 1822.

Ascochilus Ridl. in Journ. Linn. Soc. Bot. 32: 374, Nov. 2, 1896.
Lectotype: *Ascochilus siamensis* Ridl.

Characterized by the distinct column-foot which continues as a fleshy backwall in the lip. Lip very fleshy, practically solid with a very narrow, almost hair-thin tube extending in its full length; the entrance to this tube is a narrow slit at the base of the lip. Pollinia 2, slightly notched on slender stipe.

The genus must be typified by *Ascochilus siamensis* for Ridley's generic description is drawn primarily from that plant. Holttum's contention that *Ascochilus* is referable to *Pteroceras* is not tenable, for the latter genus has a differently constructed lip and the column-foot is not continuous with the lip.

Ascochilus calceolaris (Teijs. & Binn.) Garay showing the generic characters is illustrated by J. J. Smith, Orch. Java, fig. 423 under a wrong identification as *Sarcochilus emarginatus* Rchb.f. *Ascochilus pulvinatus* Guillaum. is *Thrixspermum merguense* (Hook.f.) O. Ktze. and *Ascochilus vietnamensis* Guillaum. is *Malleola dentifera* J.J.Sm.

Ascochilus calceolaris (Teijs. & Binn.) Garay, *comb. nov.*
Basionym: *Aerides calceolaris* Teijs. & Binn. in Nat. Tijdschr. Ned. Ind. 27: 19, 1864.
Syn.: *Thrixspermum mindanaense* Ames in Phil. Journ. Sci. Bot. 8: 436, 1913.

Ascochilus fasciculatus (Carr.) Garay, *comb. nov.*
Basionym: *Sarcochilus fasciculatus* Carr in Gard. Bull. Str. Settl. 5: 28, 1929.

Ascochilus leytensis (Ames) Garay, *comb. nov.*
Basionym: *Sarcochilus leytensis* Ames, Orchid 5: 211, 1915.

Biermannia King & Pantl. in Journ. As. Soc. Bengal 66: 591, Nov. 24, 1897.
Type: *Biermannia quinquecallosa* King & Pantl.

Characterized by a short, but distinct foot to the column to which the lip is adnate more or less rectangularly so that it is completely parallel with the column. The sessile lip is jointed with the column-foot, its sides enveloping or parallel with the column which is about half as long. At the base of the spurless lip there is a small and narrow slit-like opening leading to a very small, hidden gibbosity which in *B. bimaculata* King & Pantl. is semiseptate. Pollinia 2, slightly notched on linear-oblong stipe.

Biermannia bigibba (Schltr.) Garay, *comb. nov.*
Basionym: *Thrixspermum bigibbum* Schltr. in Engl. Bot. Jahrb. 45, Beibl. 104: 58, 1911.

Biermannia ciliata (Ridl.) Garay, *comb. nov.*
Basionym: *Dendrocolla ciliata* Ridl. in Journ. Str. Br. Roy. As. Soc. 44: 192, 1905.
Syn.: *Thrixspermum blepharolobum* Schltr. in Orchis 5: 53, 1911.
Sarcochilus ciliatus (Ridl.) J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 8: 63, 1926.
Pteroceras ciliatum (Ridl.) Holttum in Kew Bull. 14: 269, 1960.

Biermannia decipiens (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcochilus decipiens* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 2: 106, 1920.

Biermannia flava (Carr) Garay, *comb. nov.*
Basionym: *Chamaeanthus flavus* Carr. in Gard. Bull. Str. Settl. 5: 32, 1929.

Biermannia laciniata (Carr.) Garay, *comb. nov.*
Basionym: *Chamaeanthus laciniatus* Carr. in Gard. Bull. Str. Settl. 5: 31, 1929.

Biermannia sarcanthoides (Ridl.) Garay, *comb. nov.*
Basionym: *Bulbophyllum sarcanthoides* Ridl. in Journ. Str. Br. Roy. As. Soc. 50: 131, 1908.
Syn.: *Chamaeanthus sarcanthoides* (Ridl.) Carr. in Gard. Bull. Str. Settl. 7: 40, 1932.

Bogoria J.J.Sm. in Fl. Buitenz. 6: 566, 1905.
Type: *Bogoria Raciborskii* J.J.Sm.

Characterized by long, slender, branching inflorescences with short-lived, minute flowers produced in succession. Column is extended into a long excavate and channel-like foot which is continuous with the lip. Pollinia 2, each split in equal halves.

Bogoria taeniorhiza (Schltr.) Schltr. probably represents a different genus because of the two separate stipes to the pollinia, a condition known only among African and American genera. I have not yet seen any material.

Bogoria Merrillii (Ames) Garay, *comb. nov.*

Basionym: *Sarcochilus Merrillii* Ames, Orchid. 5: 213, 1915.

Brachypeza Garay, *gen. nov.*

Type: *Saccolabium Archytas* Ridl.

Etymology: *brachys* = short, and *peza* = foot, in reference to the characteristically short column-foot.

Sepala petalaque patentia, libera. Sepalum posticum erectum, concavum plus minusve incurvum. Sepala lateralia obliqua. Labellum pede columnae articulatum, dependens, rectum vel arcuatum, tubuloso-calcaratum, superne 3-lobum; lobis lateralibus erectis, valde productis, lobo intermedio vulgo minuto, recurvo. Columna arcuatim erecta, elongata, supra juxta stigma dilatata, infra in pedem brevem vel vix ullum producta. Stigma magnum, terminale. Rostellum valde productum, bidentatum. Pollinia 2, basin versus semidivisa, stipiti cuneato-triangulari affixa; glandula distincte evoluta.

Herbae epiphyticae; caulibus abbreviatis, foliosis; foliis carnosis, paucis distichis; inflorescentiis patentibus, vel pendulis, longe pedunculatis, supra racemosis; floribus fugaceis, succedaneis.

The elongate column with a short foot, the hanging lip and the peculiar pollinia, each of which is divided to the middle at the basal half where it is attached to the

stipe, readily differentiates this genus from *Pteroceras* Hassk. It differs from *Grosourdya* Rchb.f. in not having the angular bend in the column and in the structure of the pollinia which in *Grosourdya* Rchb.f. are characterized by the presence of distinct caudicles.

Brachypeza Archytas (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium Archytas* Ridl. in Journ. Str. Br. Roy. As. Soc. 23: 137, 1891.

Brachypeza indusiata (Rchb.f.) Garay, *comb. nov.*

Basionym: *Thrixspermum indusiatum* Rchb.f. in Gard. Chron. n.s. 25: 585, May 1886.

Syn.: *Thrixspermum platyphyllum* Rchb.f. in Bot. Centralbl. 28: 343: Nov. 1886.

Sarcochilus keyensis J.J.Sm. in Icon. Bogor. 3: 49, t. 219, 1906.

Brachypeza koeteiensis (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus koeteiensis* Schltr. in Bull. Herb. Boiss. ser. 2, 6: 467, 1906.

Brachypeza minimipes (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcochilus minimipes* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 9: 183, 1927.

Brachypeza stenoglottis (Hook.f.) Garay, *comb. nov.*

Basionym: *Sarcochilus stenoglottis* Hook.f., Fl. Brit. Ind. 6: 34, 1890.

Syn.: *Sarcochilus sigmoideus* Ridl. in Journ. Linn. Soc. Bot. 31: 298, 1896.

Pteroceras stenoglottis (Hook.f.) Holttum in Kew Bull. 14: 271, 1960.

Brachypeza zamboangensis (Ames) Garay, *comb. nov.*

Basionym: *Sarcochilus zamboangensis* Ames, Sched. Orch. 5: 39, 1923.

Camarotis Lindl. Gen. and Sp. Orch. Pl. 219, May 1833.

Type: *Camarotis purpurea* Lindl.

This genus is a synonym of *Micropera* Lindl.

Chamaeangis Schltr. in Beih. Bot. Centralbl. 36, pt. 2: 107, March 30, 1918.
Lectotype: *Angraecum gracile* Thou.

Characterized by the very short stem which gives to the plant an acaulescent habit. Column very short and uniformly thick; rostellum short. Pollinia 2, either on two or on one stipe, but with a common viscidium. The spur of the lip is almost parallel or appressed to the ovary and always wider at the apex than at the base.

Chamaeangis Boutoni (Rchb.f.) Garay, *comb. nov.*
Basionym: *Angraecum Boutoni* Rchb.f., Otia Bot. Hamb. pt. 2: 117, 1881.

Chamaeangis Hildebrandtii (Rchb.f.) Garay, *comb. nov.*
Basionym: *Angraecum Hildebrandtii* Rchb.f. in Gard. Chron. n.s. 9: 725, 1878.

Chamaeangis Humbloti (Rchb.f.) Garay, *comb. nov.*
Basionym: *Saccolabium Humbloti* Rchb.f. in Flora 48: 537, 1885.
Syn.: *Angraecum saccolabioides* H. Perr. in Humb., Fl. Madag. Orch. 2: 209, 1941.

Cheirorchis Carr in Gard. Bull. Str. Settl. 7: 40, Sept. 15, 1932.
Lectotype: *Cheirorchis breviscapa* Carr (Holttum in Kew Bull. 14; 272, 1960).

This genus is a synonym of *Cordiglottis* J.J.Sm.

Chiloschista Lindl. in Bot. Reg. 18: sub t. 1522, Sept. 1, 1832.
Type: *Epidendrum usneoides* D. Don.

Characterized by a short column with at least twice as long a column-foot to which the petals and the lateral sepals are adnate laterally. Clinandrium shallow. Pollinia 2, each deeply split into unequal halves on a linear

stipe with a small gland. Lip articulate with columnfoot, 3-lobed, saccate; lateral lobes erect, midlobe commonly abbreviated, disc with a hairy callus. Anther on both sides provided with a peculiar appendage which may be very long and glandular tipped or may be much reduced up to a small tooth. Plants epiphytic with flattened roots and commonly leafless, at least at time of flowering. *Chiloschista Godeffroyana* (Rchb.f.) Schltr., however, may have leaves present at time of flowering, as is the case occasionally in *C. pusilla* (Koenig) Schltr.

Chiloschista minimiflora (Hook.f.) Balak., according to the type specimen is inseparable from *C. pusilla* (Koenig) Schltr.

Chiloschista Exuperei (Guillaum.) Garay, *comb. nov.*

Basionym: *Taeniophyllum Exuperei* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 29: 346, 1957.

Chroniochilus J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 26: 81, Feb. 1918.

Type: *Chroniochilus tjidadapensis* J.J.Sm.

Characterized by the caulescent habit. Column with a distinct foot to which the lip is elastically attached; rostellum prominent. Pollinia 2, entire, without any notch or cleft, on a linear-oblong stipe. Lip sessile, conical with large, ear-like side lobes; the conical part is solid and there is no spur.

Chroniochilus ecalcaratus (Holttum) Garay, *comb. nov.*

Basionym: *Sarcochilus Carrii* Holttum in Gard. Bull. Singap. 11: 288, 1947, not L.O.Wms. 1937.

Syn.: *Sarcochilus ecalcaratus* Holttum, Rev. Fl. Malay. 1: 684, 1953.

Pteroceras ecalcaratum (Holttum) Holttum in Kew Bull. 14: 270, 1960.

Chroniochilus thrixspermoides (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus thrixspermoides* Schltr. in Fedde Rep. 11: 145, 1912.

Cleisocentron Brühl. Guide Orch. Sikkim 136, 1926.
Type: *Saccolabium trichromum* Rchb.f.

Characterized by an erect, cylindric column with a more or less developed column-foot which is decurrent on the dorsal wall of the lip as a thickened cushion. Clinandrium shallow. Stigma oval, vertical. Rostellum distinct, porrect or arrect, bilobed with broad lobes. Pollinia 2, globose, each deeply split into unequal sizes on a single, linear stipe; gland large, subquadrate. Lip firmly adnate to column, urceolate, lobulate above. Inflorescence axillary, many-flowered, racemose.

Cleisocentron Collettianum (King & Pantl.) Garay, *comb. nov.*
Basionym: *Saccolabium Collettianum* King & Pantl. in Journ. As. Soc. Bengal 66: 592, 1897.

Cleisocentron Klossii (Ridl.) Garay, *comb. nov.*
Basionym: *Saccolabiam Klossii* Ridl. in Journ. Nat. Hist. Soc. Siam 4: 120, 1921.
Syn.: *Cleisostoma langbianense* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 31: 272, 1959.

Cleisomeria Lindl. ex G. Don in Loud., Encycl. ed. 4, Suppl. 2: 1447, May 1855.
Type: *Cleisostoma lanatum* Lindl. [*ibid.*, p. 1472].

This genus has been completely overlooked by the compilers of Index Kewensis. Don gives the following generic description: "Sepals keeled. Lip didymous. Lateral lobes erect bifid, middle one concave bisetose at top. Caudicula cuneate, bifid, elongated." This diagnosis may be augmented by the nature of the inflorescence, *i.e.*, the flowers, ovaries, bracts and rhachis are lanate to densely pubescent, a character unique in the whole alliance. The broad and deeply split, Y-shaped stipe is not known in this relationship; pollinia 2, globose, each unequally split. Anther more or less reclined.

So far, I know of only two species referable to this very distinct genus. Of the second species, *Cleisomeria pilosula*, there is an excellent detailed watercolor in the collections at Kew prepared from living material collected by Kerr, no. 156, in Laos.

Cleisomeria pilosula (Gagn.) Seidenf. & Garay in Bot. Tidskr. 67: 120, 1972.

Basionym: *Cleisostoma pilosulum* Gagn. in Bull. Soc. Bot. Fr. 79: 35, 1932.

Syn.: *Saccolabium pilosulum* (Gagn.) Tang & Wang in Acta Phytotax. Sin. 1: 97, 1951.

Cleisostoma Bl., Bijdr. 6: t. 3, June 1825.

Type: *Cleisostoma sagittatum* Bl.

When J.J. Smith published his nomenclatorial revision of the genus *Sarcanthus* he exclaimed: "It is really remarkable that one could have had *Sarcanthus* Lindl. and *Cleisostoma* Bl. next to one another, although it [follows] is rather obvious not only from the generic descriptions, but also from the species assigned to them at the beginning that they completely overlap one another. Since *Sarcanthus* Lindl. is older, *Cleisostoma* must be added to it as a synonym." (free translation) I wholly concur with Smith that the two genera are inseparable taxonomically. However, *Cleisostoma* is the name that should be adopted instead of *Sarcanthus* for two independent reasons. 1. *Sarcanthus* Lindl. as currently used is a later homonym, hence illegitimate. 2. It has been established beyond any doubt that *Cleisostoma* antedates *Sarcanthus*.

Sarcanthus was published by Lindley for the first time in 1824 and he based his diagnosis on *Epidendrum praemorsum* Roxb., now included in the genus *Acampe*. In 1826, Lindley published *Sarcanthus* the second time typifying it by *S. rostratus* Lindl. This second *Sarcan-*

thus is illegitimate for it represents a later homonym. Between these two dates, in 1825, Blume published *Cleisostoma* in the Key to genera of Javanese orchids issued with part six of his Bijdragen, and illustrated its salient features on figure 27 of his Tabellen under *Cleisostoma sagittata*. Hence, this species must be regarded as the type of the genus.

One of the main characters of the genus is the large callus on the backwall of the spur of the lip, which is more or less grooved, and, either alone or in conjunction with other excrescences at the base of the main lamina of the lip, completely closes the entrance to the nectariferous spur. Column short and stout, often pyramidal, *i.e.*, wider at base, footless or with distinct foot. Pollinia 2, each unequally split in halves, on distinct stipe. The stipe shows a remarkable variation; it may be rather slender, linear with a small, subglobose viscidium or it may be triangular or broadly rectangular and attached to a horseshoe-shaped viscidium. It seems that the two types of pollinia are closely associated with the presence or the absence of a column-foot, but whether this holds throughout the genus is pending further studies.

Cleisostoma arietinum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus arietinus* Rchb.f. in Gard. Chron. 416, 1869.

Cleisostoma aspersum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus aspersus* Rchb.f. in Hamb. Gartenz. 21: 297, 1865.

Cleisostoma auriculatum (Rolfe) Garay, *comb. nov.*
Basionym: *Sarcanthus auriculatus* Rolfe in Kew Bull. 9, 1895.

Cleisostoma Beccarii (Schltr.) Garay, *comb. nov.*
Basionym: *Sarcanthus Beccarii* Schltr. in Notizbl. Bot. Gart. u. Mus. Berlin 8: 20, 1921.

Cleisostoma belophorum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus belophorus* Rchb.f. in Gard. Chron. n.s. 20: 262, 1883.

Cleisostoma bicorne (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus bicornis* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 19: 35, 1908.

Cleisostoma bicrure (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium bicrure* Ridl. in Journ. Str. Br. Roy. As. Soc. 44: 190, 1905.

Cleisostoma bilamellatum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus bilamellatus* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 5: 28, 1907.

Cleisostoma birmanicum (Schltr.) Garay, *comb. nov.*

Basionym: *Echioglossum birmanicum* Schltr. in Notizbl. Bot. Gart. u. Mus. Berlin 8: 125, 1922.

Cleisostoma brachystachys Garay, *comb. nov.*

Basionym: *Saccolabium brachystachys* Ridl. in Journ. Str. Br. Roy. As. Soc. 49: 36, 1907.

Cleisostoma buruense (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus buruensis* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 9: 476, 1928.

Cleisostoma callosilobum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus callosilobus* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 10: 79, 1928.

Cleisostoma capricorne (Ridl.) Garay, *comb. nov.*

Basionym: *Ascochilus capricornis* Ridl. in Journ. Fed. Malay. States Mus. 10: 153, 1920.

Cleisostoma carinatum (Rolfe ex Downie) Garay, *comb. nov.*

Basionym: *Sarcanthus carinatus* Rolfe ex Downie in Kew Bull. 408, 1925.

Cleisostoma chapaënse (Guillaum.) Garay, *comb. nov.*

Basionym: *Sarcochilus chapaënsis* Guillaum. in Bull. Soc. Bot. Fr. 77: 328, 1930.

Cleisostoma chrysomelas (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus chrysomelas* Rchb.f. in Gard. Chron. 662, 1869.

Cleisostoma complicatum (Seidenf.) Garay, *comb. nov.*

Basionym: *Sarcanthus complicatus* Seidenf. in Saert. Bot. Tidsskr. 65: 361, 1970.

Cleisostoma crassissimum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus crassissimus* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 25: 98, 1917.

Cleisostoma Crochetii (Guillaum.) Garay, *comb. nov.*

Basionym: *Sarcanthus Crochetii* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 28: 238, 1956.

Cleisostoma crucicallum (Burkill) Garay, *comb. nov.*

Basionym: *Saccolabium crucicallum* Burkill in Gard. Bull. Str. Settl. 3: 17, 1923.

Cleisostoma Demanzei (Guillaum.) Garay, *comb. nov.*
Basionym: *Sarcanthus Demanzei* Guillaum. in Bull. Soc. Bot. Fr. 77: 329, 1930.

Cleisostoma Draco (Tuyama) Garay, *comb. nov.*
Basionym: *Sarcanthus Draco* Tuyama in Bot. Mag. Tokyo 53: 55, 1939.

Cleisostoma duplicilobum (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus duplicilobus* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 13: 64, 1907.

Cleisostoma elongatum (Rolfe) Garay, *comb. nov.*
Basionym: *Sarcanthus elongatus* Rolfe in Journ. Linn. Soc. 36: 36, 1903.

Cleisostoma fallax (Guillaum.) Garay, *comb. nov.*
Basionym: *Sarcanthus fallax* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 33: 334, 1961.

Cleisostoma filiforme (Lindl.) Garay, *comb. nov.*
Basionym: *Sarcanthus filiformis* Lindl. in Bot. Reg. 28: Misc. p. 61, 1842.

Cleisostoma flagellare (Schltr.) Garay, *comb. nov.*
Basionym: *Sarcanthus flagellaris* Schltr. in Fedde Rep. Beih. 4: 76, 1919.

Cleisostoma flagelliforme (Rolfe ex Downie) Garay, *comb. nov.*
Basionym: *Sarcanthus flagelliformis* Rolfe ex Downie in Kew Bull. 393, 1925.

Cleisostoma flexum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus flexus* Rchb.f. in Gard. Chron. n.s. 16: 492, 1881.

Cleisostoma fuscomaculatum (Hayata) Garay, *comb. nov.*
Basionym: *Sarcanthus fuscomaculatus* Hayata, Icon. Pl. Formos. 4: 94, 1914.

Cleisostoma Gjellerupii (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus Gjellerupii* J.J.Sm. in Fedde Rep. 10: 488, 1912.

Cleisostoma halophilum (Ridl.) Garay, *comb. nov.*
Basionym: *Sarcanthus halophilus* Ridl. in Journ. Linn. Soc. 32: 367, 1896.

Cleisostoma Hincksianum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus Hincksianus* Rchb.f. in Gard. Chron. n.s. 9: 73, 1878.

Cleisostoma Holttumii (Carr) Garay, *comb. nov.*
Basionym: *Sarcanthus Holttumii* Carr in Gard. Bull. Str. Settl. 5: 17, 1929.

Cleisostoma hongkongense (Rolfe) Garay, *comb. nov.*
Basionym: *Sarcanthus hongkongensis* Rolfe in Kew Bull. 198, 1898.

Cleisostoma inflatum (Rolfe) Garay, *comb. nov.*
Basionym: *Sarcanthus inflatus* Rolfe in Kew Bull. 115, 1906.

Cleisostoma inflexilobum (Holttum) Garay, *comb. nov.*
Basionym: *Sarcanthus inflexilobus* Holttum in Gard. Bull. 11: 288, 1947.

Cleisostoma javanicum (Bl.) Garay, *comb. nov.*
Basionym: *Echioglossum javanicum* Bl., Bijdr. 8: 365, 1825.

Cleisostoma koeteiense (Schltr.) Garay, *comb. nov.*
Basionym: *Saccolabium koeteiense* Schltr. in Fedde Rep. 3: 280, 1907.

Cleisostoma krabiense (Seidenf.) Garay, *comb. nov.*
Basionym: *Sarcanthus krabiensis* Seidenf. in Saert. Bot. Tidsskr. 64: 153, 1969.

Cleisostoma Krempfii (Guillaum.) Garay, *comb. nov.*
Basionym: *Sarcanthus Krempfii* Guillaum. in Bull. Soc. Bot. Fr. 77: 329, 1930.

Cleisostoma Lendyana (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus Lendyanus* Rchb.f. in Gard. Chron. n.s. 21: 44, 1884.

Cleisostoma linerilobatum (Seidenf. & Smitin.) Garay, *comb. nov.*
Basionym: *Sarcanthus linearilobatus* Seidenf. & Smitin., Orch. Thailand 4, pt. 2: 684, 1965.

Cleisostoma litoreum (Schltr.) Garay, *comb. nov.*
Basionym: *Sarcanthus litoreus* Schltr. in Fedde Rep. Beih. 1: 990, 1913.

Cleisostoma lophochilum (Gagn.) Garay, *comb. nov.*
Basionym: *Sarcanthus lophochilus* Gagn. in Bull. Mus. Hist. Nat. Paris, ser. 2, 22: 630, 1950.

Cleisostoma montanum (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus montanus* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl 13: 67, 1907.

Cleisostoma muticum (Rchb.f.) Garay, *comb. nov.*
Basionym: *Echioglossum muticum* Rchb.f. in Bonpl. 3: 225, 1855.

Cleisostoma Nieuwenhuissii (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus Nieuwenhuissii* J.J.Sm. in Icon. Bogor. 3: 57, 1906.

Cleisostoma odoratum Garay, *nom. nov.*
Basionym: *Cleisostoma ionosmum* Ridl. in Journ. Linn. Soc. 32: 366, 1896, not Lindl. 1847.

Cleisostoma ornithorrhynchum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus ornithorrhynchus* Rchb.f. in Allgem. Gartenz. 24: 219, 1856.

Cleisostoma paniculatum (Ker-Gawl.) Garay, *comb. nov.*

Basionym: *Aerides paniculatum* Ker-Gawl. in Bot. Reg. 3: t. 220, 1817.

Cleisostoma Parishii (Hook.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus Parishii* Hook.f. in Bot. Mag. 86: t. 5217, 1860.

Cleisostoma pensile (Ridl.) Garay, *comb. nov.*

Basionym: *Sarcanthus pensilis* Ridl. in Journ. Linn. Soc. Bot. 32: 369, 1896.

Cleisostoma piliferum (Guillaum.) Garay, *comb. nov.*

Basionym: *Sarcanthus pilifer* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 36: 538, 1965.

Cleisostoma pityophyllum (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium pityophyllum* Ridl. in Journ. Fed. Malay States Mus. 8: 108, 1917.

Cleisostoma porrigens (Fukuyama) Garay, *comb. nov.*

Basionym: *Sarcanthus porrigens* Fukuyama in Trans. Nat. Hist. Soc. Formosa 28: 5, 1938.

Cleisostoma Posthumii (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus Posthumii* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 14: 166, 1937.

Cleisostoma potamophilum (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcanthus potamophilus* Schltr. in Fedde Rep. 3: 279, 1907.

Cleisostoma pinifolium (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium pinifolium* Ridl. in Journ. Str. Br. Roy. As. Soc. 50: 141, 1908.

Cleisostoma pugioniforme (Klotzsch) Garay, *comb. nov.*

Basionym: *Angraecum pugioniforme* Klotzsch in Ind. Sem. Hort. Berol. 1, 1851.

Cleisostoma quinquefidum (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium quinquefidum* Lindl. in Hook. Lond. Journ. Bot. 2: 238, 1843.

Cleisostoma racemiferum (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium racemiferum* Lindl. Gen. and Sp. Orch. Pl. 224, 1833.

Cleisostoma rhyncholabium Garay, *nom. nov.*

Basionym: *Malleola callosa* Carr in Journ. Malay Br. Roy. As. Soc. 11: 101, 1933.

Cleisostoma Ridleyi Garay, *nom. nov.*
Basionym: *Saccolabium ramosum* Ridl. in Journ. Str. Br. Roy. As. Soc. 44: 190, 1905, not *Cleisostoma ramosum* (Lindl.) Hook.f.

Cleisostoma Rolfeanum (King & Pantl.) Garay, *comb. nov.*
Basionym: *Sarcanthus Rolfeanus* King & Pantl. in Journ. As. Soc. Bengal 66: 594, 1897.

Cleisostoma rostellatum (Ridl.) Garay, *comb. nov.*
Basionym: *Sarcanthns rostellatus* Ridl. in Journ. Bot. 38: 72, 1900.

Cleisostoma rostratum (Lindl.) Garay, *comb. nov.*
Basionym: *Sarcanthus rostratus* Lindl., Coll. Bot. t. 39B, 1826.
Syn.: *Sarcanthus laosensis* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 35: 650, 1963.

Cleisostoma sacculatum (Ridl.) Garay, *comb. nov.*
Basionym: *Sarcanthus sacculatus* Ridl. in Journ. Linn. Soc. 32: 368, 1896.

Cleisostoma sagittiforme Garay, *nom. nov.*
Basionym: *Sarcanthus sagittatus* King & Pantl. in Journ. As. Soc. Bengal 66: 595, 1897, not *Cleisostoma sagittatum* Bl. 1825.

Cleisostoma samarindae (Schltr.) Garay, *comb. nov.*
Basionym: *Saccolabium samarindae* Schltr. in Fedde Rep. 3: 280, 1907.

Cleisostoma Schlechteri Garay, *nom. nov.*
Basionym: *Sarcanthus robustus* Schltr. in Fedde Rep. Beih. 1: 991, 1913, not *Cleisostoma robustum* Guillaum. 1930.

Cleisostoma scolopendrifolium (Makino) Garay, *comb. nov.*
Basionym: *Sarcanthus scolopendrifolius* Makino, Ill. Fl. Japan 1: t. 40, 1891.

Cleisostoma Scortechinii (Hook.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus Scortechinii* Hook.f., Fl. Brit. Ind. 6: 68, 1890.

Cleisostoma Seidenfadenii Garay, *nom. nov.*
Basionym: *Sarcanthus saimensis* Rolfe ex Downie in Kew Bull. 405, 1925, not *Cleisostoma siamensis* Rolfe ex Downie 1925.
Syn.: *Luisia acutilabris* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 32: 188, 1960.

Cleisostoma Simondianum (Gagn.) Garay, *comb. nov.*
Basionym: *Sarcanthus Simondianus* Gagn. in Bull. Mus. Hist. Nat. Paris, ser. 2, 22: 630, 1950.

Cleisostoma sororium (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Sarcanthus sororius* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 25: 100, 1917.

Cleisostoma striatum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Echioglossum striatum* Rchb.f. in Gard. Chron. n.s. 12: 390, 1879.

Cleisostoma striolatum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus striolatus* Rchb.f. in Gard. Chron. n.s. 18: 168, 1882.

Cleisostoma strongyloides (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium strongyloides* Ridl. in Journ. Str. Br. Roy. As. Soc. 50: 141, 1908.

Cleisostoma suffusum (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium suffusum* Ridl. in Journ. Str. Br. Roy. As. Soc. 44: 189, 1905.

Cleisostoma sumbavense (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus sumbavensis* J.J.Sm. in Meded. Rijks. Herb. 53: 16, 1925.

Cleisostoma tenuifolium (L.) Garay, *comb. nov.*

Basionym: *Epidendrum tenuifolium* L., Sp. Pl. pt. 2: 952, 1753.

Syn.: *Luisia tenuifolia* (L.) Bl. in Mus. Lugd. Batav. 1: 64: 1849.
Sarcanthus peninsularis Dalzell in Hook. Journ. Bot. and Kew Misc. 3: 343, 1857.
Saccolabinm acuminatum Thw., Enum. Pl. Ceylon 304, 1861.
Sarcanthus tenuifolius (L.) Seidenf. in Dansk Bot. Ark. 27, pt. 4: 37, 1971.

Cleisostoma tenuirachis (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus tenuirachis* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 22: 50, 1909.

Cleisostoma teres Garay, *nom. nov.*

Basionym: *Vanda teretifolia* Lindl., Coll. Bot. t. 6, 1821, not *Cleisostoma teretifolium* Teijs. & Binn., 1864.

Syn.: *Sarcanthus teretifolius* (Lindl.) Lindl., Gen. and Sp. Orch. Pl. 234, 1833.

Cleisostoma termissum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus termissus* Rchb.f. in Hamb. Gartenz. 16: 15, 1860.

Cleisostoma unciferum (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcanthus uncifer* Schltr. in Fedde Rep. 19: 383, 1924, as "unciferus".

Cleisostoma viridescens (Fukuyama) Garay, *comb. nov.*

Basionym: *Sarcanthus viridescens* Fukuyama in Bot. Mag. Tokyo 50: 24, 1936.

Cleisostoma Weberi (Ames) Garay, *comb. nov.*

Basionym: *Sarcanthus Weberi* Ames, Orchid. 5: 252, 1915.

Cleisostoma Williamsoni (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus Williamsoni* Rchb.f. in Gard. Chron. 674, 1865.

Cordiglottis J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 5: 95, June 1922.
Type: *Cordiglottis Westenenkii* J.J.Sm.

Characterized by the prominent column-foot which is articulate with the lip. Lip clawed, more or less sigmoid without a spur. Pollinia 2, each more or less unequally split in halves on short, broadly spathulate stipe with large viscidium.

Cheirorchis Carr is identical in every salient feature with *Cordiglottis*.

Cordiglottis breviscapa (Carr) Garay, *comb. nov.*
Basionym: *Cheirorchis breviscapa* Carr in Gard. Bull. Str. Settl. 7: 41, 1932.

Cordiglottis filiformis (Hook.f.) Garay, *comb. nov.*
Basionym: *Sarcochilus filiformis* Hook.f., Fl. Brit. Ind. 6: 39, 1890.
Syn.: *Cheirorchis filiformis* (Hook.f.) Carr in Gard. Bull. Str. Settl. 7: 46, 1932.

Cordiglottis fulgens (Ridl.) Garay, *comb. nov.*
Basionym: *Dendrocolla fulgens* Ridl. in Journ. Linn. Soc. 32: 383, 1896.
Syn.: *Cheirorchis fulgens* (Ridl.) Carr in Gard. Bull. Str. Settl. 7: 46, 1932.

Cordiglottis major (Carr) Garay, *comb. nov.*
Basionym: *Cheirorchis major* Carr in Gard. Bull. Str. Settl. 7: 43, 1932.

Cordiglottis multicolor (Ridl.) Garay, *comb. nov.*
Basionym: *Dendrocolla multicolor* Ridl. in Journ. Str. Br. Roy. As. Soc. 54: 54, 1909.

Cordiglottis pulverulenta (Carr) Garay, *comb. nov.*
Basionym: *Cheirorchis pulverulenta* Carr in Gard. Bull. Settl. 7: 45, 1931.

Cryptopylos Garay, *gen. nov.*
Type: *Sarcochilus clausus*, J.J.Sm.

Etymology : from *kryptos* = hidden and *pylos* = orifice, in reference to the small aperture of the labellar cavity which is concealed in the fleshy apex.

Sepalum posticum erectum, cucullatum. Sepala lateralia semireflexa ad pedem columnae decurrentia. Petala reflexa seu patentia. Labellum cum pede columnae articulatum, mobile, calcaratum, lateraliter compressum, fauce lamella horizontali omnino adnata, carnosula, ad apicem labelli tantum perforata clausum. Columna recta, basi in pedem longum, sepala lateralia superantem producta. Clinandrium humile. Rostellum conspicuum, cum columna angulum subrectum faciens. Stigma magnum, suborbiculare. Pollinia 2, indivisa, perforata, stipitem lineari-spatulatum affixa; viscidium magnum, ellipticum. Anthera bilocularis, subcordata, antice truncata.

Herbae epiphyticae; caulibus abbreviatis, internodiis, brevibus; foliis carnosis, paucis; inflorescentiis laxe plurifloris, quaquaversis, rhachide angulata; bracteis brevibus, adpressis; floribus majusculis.

It differs from *Macropodanthus* L. O. Wms. in the shape of the rostellum and the construction of the closed lip; from *Grosourdya* Rchb.f. it differs in the structure of the pollinia and lip.

Cryptopylos clausus (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcochilus clausus* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 5: 93, 1922.

Syn.: *Pteroceras clausum* (J.J.Sm.) Seidenf. & Smitin., Orch. Thailand 4: 532, 1963.

Sarcochilus Pierrei Guillaum. in Bull. Soc. Bot. Fr. ser. 5, 6: 327, 1930.

Cyrtorchis Schltr., Die Orchideen 595. Nov. 28, 1914.

Lectotype: *Angraecum arcuatum* Lindl. [Summerhayes in Kew Bull. 3: 278, 1948].

Characterized by the similar, narrow and pointed floral segments all of which are arcuately spreading: the spur of the lip at least twice as long as the blade, gradually tapering from a wide base to the tip. Rostellum prominent, longer than the short column, bifid. Pollinia 2, each on separate stipes with a common viscidium.

Cyrtorchis crenata (Rchb.f. ex Wms.) Garay, *comb. nov.*

Basionym: *Angraecum crenatum* Rchb.f. ex Wms., Orch. Grow. Man. ed. 6, 115, 1885.

Drymoanthus Nicholls in Vict. Nat. 59: 173, Feb. 1943.

Type: *Drymoanthus minutus* Nicholls.

Characterized by the short, entirely footless column to which the sessile lip is firmly adnate at a right angle. Lip more or less concave without a spur. Pollinia 2, each more or less split in unequal halves. Plants very small, stem abbreviated.

Drymoanthus minimus (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus minimus* Schltr. in Fedde Rep. 3: 110, 1906.

Eparmatostigma Garay, *gen. nov.*

Type: *Saccolabium dives* Rchb.f.

Etymology: *eparmatos* = a swelling and *stigma* = stigma, in reference to the shape of the stigma which is protruding from the column like an inflated bubble.

Sepala petalaque patentia, similia, nisi petala minora. Labellum urceolare, pendulum, lateraliter compressum, apice subito attenuato, laciniis lateralibus subtruncatis, minutis, lacinia mediana porrecta, interdum uncata. Columna humilis, crassa, apoda. Clinandrium haud productum. Stigma ovale, perpendiculare, gibboso-inflatum. Rostellum alte carinatum, bidentatum, oblique insertum. Pollinia 2, globosa, foraminifera, stipiti genuflexi, anguste lineari-spathulati affixa; glandula parva.

Herbae epiphyticae, pendentes; caulibus valde abbreviatis, compressis, paucifoliatis; foliis lineari-ligulatis, apice oblique bilobis; inflorescentia axillari, pendula, breviter pedunculata, rhachide dense multiflora, racemosa; floribus minutis, satis carnosis.

The general appearance of the flowers are reminiscent of those of *Mallcola* J.J.Sm. & Schltr., but the structure of the pollinia and the inflated, bubble-like, vertical stigma is very different. The structure of the stigma coupled with the porate pollinia differentiates the plants of this genus in the entire monopodial alliance.

Eparmatostigma dives (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium dives* Rchb.f. in Gard. Chron. n.s. 4: 130, 1875.

Syn.: *Saccolabium chrysoplectrum* Guillaum. in Bull. Soc. Bot. Fr. 77: 333, 1930.

Saccolabium chrysoplectrum var. *albiflorum* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 36: 538, 1964.

Gastrochilus D. Don, Prodr. Fl. Nepal. 32, Feb. 1, 1825.

Type: *Aerides calceolare* Buch.-Ham. ex J.E.Smith.

Characterized by the very short, stout column without a foot. Lip is basin-shaped to semiglobose with its sides firmly adnate to column. Pollinia 2, porate or slightly notched, never split on linear stipe. Rostellum short, bifid.

It is a very distinct genus which through lack of knowledge of details has been united with *Saccolabium* and so conserved in 1905. Ridley finds "its great peculiarity . . . that the lateral lobes of the lip meet and are connate in front, so to form a wall between the mouth of the spur and the epichil, instead of having free apices."

Gastrochilus crassilabris (King & Pantl.) Garay, *comb. nov.*

Basionym: *Saccolabium crassilabre* King & Pantl. in Journ. As. Soc. Bengal 66: 593, 1897.

Gastrochilus indicus Garay, *nom. nov.*

Basionym: *Vanda pulchella* Wight, Icon. Pl. Ind. Orient. 5: 9, t. 1671, 1851.

Syn.: *Saccolabium nilagiricum* Hook.f., Fl. Brit. Ind. 6: 60, 1890, *nom. illeg.*

Gastrochilus niligiricus (Hook.f.) O.Ktze., Rev. Gen. Pl. 2: 661: 1891, *nom. illeg.*

Gastrochilus pulchellus (Wight) Schltr. in Fedde Rep. 12: 215, 1913, not Ridl., 1906.

Saccolabium pulchellum (Wight) Fischer, Fl. Pres. Madras, pt, 8: 1445, 1928.

Grosourdya Rchb.f. in Bot. Zeit. 22: 297, Sept. 23, 1864.

Type: *Grosourdya elegans* Rchb.f.

Characterized by the elongate column which bends forward in an obtuse angle at the base of the stigma, as long as or longer than the column-foot. Rostellum prominent, elongate. Pollinia 2, entire, attached through distinct, often auricle-like caudicles to a narrowly triangular stipe; viscidium triangular. Lip movably jointed with column-foot, 3-lobed; lateral lobes erect, midlobe replicate on the prominent spur.

It differs from *Pteroceras* Hassk. in the peculiarly bent column, in the attachment of pollinia to the stipe and in the replicate midlobe of lip. In the rostrate column it resembles *Stereochilus* Lindl. and *Ornithochilus* Wall. ex Benth., but in both of these genera the column is footless and the structure of the lip is very different.

With the exception of *G. histrix* (Rchb.f.) which is referable to the genus *Thriaspermum*, the species enumerated by Reichenbach are all correctly placed in this genus. It should be noted that the illustration published by J. J. Smith under *Sarcochilus emarginatus* (Bl.) Rchb.f. and *Sarcochilus Zollingeri* Rchb.f. in his Orchideen von Java are based on wrong identifications and are not referable to *Grosourdya*.

Grosourdya incurvicalcar (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcochilus incurvicalcar* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 13: 39, 1914.

Grosourdya minutiflora (Ridl.) Garay, *comb. nov.*

Basionym: *Ascochilus minutiflorus* Ridl. in Journ. Str. Br. Roy. As. Soc. 39: 85, 1903.

Syn.: *Pteroceras minutiflorum* (Ridl.) Holttum in Kew Bull. 14: 270, 1960.

Grosourdya muscosa (Rolfe) Garay, *comb. nov.*

Basionym: *Sarcochilus muscosus* Rolfe in Kew Bull. 7, 1893.

Syn.: *Sarcochilus maculatus* Carr in Gard. Bull. Str. Settl. 5: 26, 1929.

Sarcochilus Carrii L.O.Wms. in Bot. Mus. Leafl. Harvard Univ. 5: 57, 1937.

Pteroceras Carrii (L.O.Wms.) Holttum in Kew Bull. 14: 269, 1960.

Grosourdya quinquelobata (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus quinquelobatus* Schltr. in Fedde Rep. 10: 205, 1911.

Grosourdya pulvinifera (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus pulviniferus* Schltr. in Fedde Rep. 10: 204, 1911.

Grosourdya tripercus (Ames) Garay, *comb. nov.*

Basionym: *Sarcochilus tripercus* Ames, Orchid. 7: 125, 1922.

Holcoglossum Schltr. in Fedde Rep. Beih. 4: 285, June 15, 1919.

Type: *Saccolabium quasipinifolium* Hayata.

Characterized by the short, footless column with prominent wings. Clinandrium deeply cleft in front; rostellum short, bifid. Pollinia 2, notched, on linear, tapering stipes. Lip sessile with a slender, arcuate spur. Stem rather short, completely enclosed by distichously arranged leaf-sheaths. Leaves articulate, triquetrous or terete.

The Japanese *Orchis falcata* Thunb. which is referable to this genus has been known in the literature under the generic names of *Neofinetia* Hu, *Finetia* Schltr. and *Nipponorchis* Masam. It is surprising to find that none of

these names have been validly published, due to lack of generic descriptions, according to the rules of the International Code of Botanical Nomenclature. To the best of my knowledge to the present none of them has been validated.

Holcoglossum falcatum (Thunb.) Garay & Sweet, *comb. nov.*

Basionym: *Orchis falcata* Thunb., Fl. Jap. 26, 1784.

Syn.: *Neofinetia falcata* (Thunb.) Hu in Rhodora 27: 107, 1925, *nomen.*

Holcoglossum Kimballianum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Vanda Kimballiana* Rchb.f. in Gard. Chron. ser. 3, 5: 232, 1889.

Syn.: *Vanda saprophytica* Gagn. in Bull. Soc. Bot. Fr. 79: 37, 1932.

Holcoglossum rupestre (Hand.-Maz.) Garay, *comb. nov.*

Basionym: *Vanda rupestris* Hand.-Maz., Symb. Sinic. 7: 1359, 1936.

Hymenorchis Schltr. in Fedde Rep. Beih. 1: 994, Sept. 1, 1913.

Type: *Oeceoclades javanica* Teijs. & Binn.

Characterized by the short column to which the saccate or spurred lip is firmly adnate. Pollinia 2, entire, more or less globose on a thin, linear stipe which at times may be somewhat broadened toward the base. Rostellum 2-lobed.

Leaf sheaths verrucose, often fimbriate-lacerate; leaves fleshy with crystalline-serrate edges. Inflorescence with a short peduncle; rhachis usually thick.

Hymenorchis Vanoverberghii (Ames) Garay, *comb. nov.*

Basionym: *Saccolabium Vanoverberghii* Ames, Orchid. 5: 230, 1915.

Jumellea Schltr., Die Orchideen 609, Nov. 28, 1914.

Lectotype: *Angraecum recurvum* Thou.

Characterized by a short column with an abbreviated rostellum and deeply cleft clinandrium. Pollinia 2, on

separate stipes or directly attached to separate viscidia. In these characters *Jumellea* agrees with *Angraecum*. It differs in the lip which is usually lanceolate and tapering toward the base and never envelops the column. The unadorned slender spur has a narrow opening. The inflorescence is always one-flowered; flowers distinctly long-pedicellate.

Jumellea Cowanii (Ridl.) Garay, *comb. nov.*

Basionym: *Angraecum Cowanii* Ridl. in Journ. Linn. Soc. 21: 484, 1885.

Loxoma Garay, *gen. nov.*

Type: *Micropera maculata* Dalzell.

Etymology: *loxos* = slanting and *-oma* = having the nature of, in reference to the reclining nature of the column.

Sepala lateralia patentia, libera. Sepalum posticum petalis plus minusve conniventia, sed inter se libera. Labellum valde carnosum, pede columnae continum, porrectum, saccatum, basin cornubus 2, reclinatis ornatum, supra lamina 3-lobata, maxima donatum, intus pilosum. Columna reclinata, humilis, crassa, basi in pedem crassum breviter producta. Clinandrium humile. Stigmata confluentia, maxima. Rostellum verticale, valde evolutum. Pollinia 2, inaequaliter bipartibilia, stipiti sulcati, lineari-oblongi affixa; glandula distincte evoluta.

Herbae epiphyticae; caulibus satis abbreviatis, paucifoliatis; foliis articulatis, carnosis, emarginatis; inflorescentiis axillaribus racemosis, laxe multifloris, fere usque ad basin floriferis; floribus carnosis, maculatis.

The characters of this new genus differ from those of *Gastrochilus*, in addition to the general appearance, in the reclining column, in the presence of a short column-foot, in the distinctly divided pollinia.

The lip is very curiously constructed. It looks like a side saddle with two horns instead of one; the sac, into which there is an opening only between the horns, is almost concealed by the lamina which hangs down in the manner of saddle-flaps. The column is reclining with a prominent bilobed vertical rostellum.

Loxoma maculatum (Dalzell) Garay, *comb. nov.*

Basionym: *Micropera maculata* Dalzell in Hook. Journ. Bot. and Kew Misc. 3: 282, 1851.

Syn.: *Sarcochilus maculatus* (Dalzell) Benth. ex Pfitz., Grundz. Vergl. Morph. Orch. 15, 1882.

Saccolabium maculatum (Dalzell) Hook.f., Fl. Brit. Ind. 6: 64, 1890.

Gastrochilus maculatus (Dalzell) O.Ktze., Rev. Gen. Pl. 2: 661, 1891.

Malleola J.J.Sm. & Schltr. in Fedde Rep. Beih. 1: 979, Sept. 1, 1913.

Lectotype: *Malleola sphingoides* J.J.Sm.

Characterized by the short hammer-shaped or malleiform column and especially by the shape of the pollinaria. The two notched pollinia are always adnate to a strongly spathulate stipe which is commonly very broad at the attachment of the pollinia.

Malleola bicruris (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Robiquetia bicruris* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 10: 20, 1928.

Malleola culicifera (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium culiciferum* Ridl. in Journ. Fed. Malay States Mus. 8: 109, 1917.

Malleola sylvestris (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium sylvestre* Ridl. in Journ. Str. Br. Roy. As. Soc. 57: 98, 1910.

Megalotus Garay, *gen. nov.*

Type: *Saccolabium bifidum* Lindl.

Etymology: *megalo* = large and *otos* = ear, in reference to the large fleshy auricles on the column.

Sepala petalaque libera, patentia, nisi petala minora. Labellum carnosum, calcaratum, 3-lobum, lobis lateralibus erectis columna parallelis, lobo intermedio recurvo, in medio articulato, apice setaceo-bifido. Columna humilis, apoda, juxta stigma auriculis valde carnosis ornata. Stigma suborbiculare. Rostellum aciculare, bifidum, arrectum. Pollinia 2, indivisa, subfalcato-obpyriformia, angulata, stipiti late obovati affixa; glandula linearis, maxima. Anthera bilocularis obscure septata.

Herbae epiphyticae; caulibus abbreviatis; foliis carnosis, paucis, distichis. Inflorescentiis gracilibus, leviter arcuatis interdum pendulis, racemosis, multifloris, distincte pedunculatis. Floribus carnosis, minutis.

The peculiar, auriculate column and the angular, entire pollinia differentiates this new genus from *Cleisostoma* Bl., *Schoenorchis* Bl. and *Malleola* J.J.Sm. & Schltr.

Megalotus bifidus (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium bifidum* Lindl. in Bot. Reg. 24: Misc. p. 3, 1838.

Syn.: *Gastrochilus bifidus* (Lindl.) O.Ktze., Rev. Gen. Pl. 2: 661, 1891.

Sarcanthus bifidus (Lindl.) Ames, Orchid. 5: 245, 1915.

Micropera Lindl. in Bot. Reg. 18: sub t. 1522. Sept. 1, 1832.

Type: *Aerides pallida* Roxb.

Characterized by a short, footless column which widens toward the apex and terminates in a prominent rostellum. Pollinia 2, each split in equal halves on long slender stipe. Lip calceolate, porrect, with the basally connate latereal sepals dorsally adnate to it.

The fact that the characters of the genera *Camarotis* Lindl. and *Micropera* Lindl. are identical has already been recognized by Lindley in 1859 (*cf.* Journ. Linn. Soc. 3: 37). Since *Micropera* antedates *Camarotis* by

about a year, it is the correct name to be used for these plants.

Micropera apiculata (Rchb.f.) Garay, *comb. nov.*

Basionym: *Camarotis apiculata* Rchb.f. in Bonpl. 5: 39, 1857.

Micropera callosa (Bl.) Garay, *comb. nov.*

Basionym: *Cleisostoma callosum* Bl., Bijdr. 8: 364, 1825.

Micropera costulata (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Camarotis costulata* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 9: 186, 1927.

Micropera fasciculata (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium fasciculatum* Lindl. in Hook. Lond. Journ. Bot. 2: 238, 1843.

Syn.: *Cleisostoma Keffordii* Bail., Rep. Queensl. Accl. Soc. 9, 1884.

Saccolabium Coplandii Bail. in Queensl. Agric. Journ. 19: 274, 1907.

Sarcanthus papuanus J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 39: 19, 1910.

Micropera fuscolutea (Lindl.) Garay, *comb. nov.*

Basionym: *Sarcochilus fuscoluteus* Lindl. in Bot. Reg. 33: sub t. 18, 1847.

Syn.: *Sarcochilus adnatus* Ridl. in Journ. Linn. Soc. 32: 373, 1896.

Saccolabium adnatum (Ridl.) Ridl., Fl. Malay Pen. 4: 174, 1924.

Camarotis latisaccata J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 9: 187, 1927.

Camarotis adnata (Ridl.) Holttum in Gard. Bull. 11: 277, 1947.

Micropera Loheri (L.O.Wms.) Garay, *comb. nov.*

Basionym: *Camarotis Loheri* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 5: 59, 1937.

Micropera philippinensis (Lindl.) Garay, *comb. nov.*

Basionym: *Camarotis philippinensis* Lindl. in Journ. Linn. Soc. 3: 37, 1859.

Micropera Poilanei (Guillaum.) Garay, *comb. nov.*

Basionym: *Sarcanthus Poilanei* Guillaum. in Bull. Soc. Bot. Fr. 77: 330, 1930.

Micropera proboscidea (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus proboscideus* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 5: 25, 1907.

Micropera sterrophylla (Schltr.) Garay, *comb. nov.*

Basionym: *Saccolabium sterrophyllum* Schltr. in Fedde Rep. 10: 201, 1911.

Micropera thailandica (Seidenf. & Smitin.) Garay, *comb. nov.*

Basionym: *Camarotis thailandica* Seidenf. & Smitin., Orch. Thailand, 4, pt. 2: 712, 1965.

Micropera uncinata (Teijs. & Binn.) Garay, *comb. nov.*

Basionym: *Aerides uncinata* Teijs. & Binn. in Tijdschr. Nederl. Ind. 24: 324, 1862.

Micropera utriculosa (Ames) Garay, *comb. nov.*

Basionym: *Camarotis utriculosa* Ames, Orchid. 5: 244, 1915.

Microtatorchis Schltr. in Schum. & Lauterb., Nachtr. pt. 2: 224, Oct. 1905.

Lectotype: *Microtatorchis perpusilla* Schltr. [Index Gen. 30/05211].

Characterized by the union of the sepals and the petals into a short, distinct tube. Pollinia 2, undivided on distinct, oblanceolate stipe. Leaves are present at least during the growing season.

The peculiar, winged rachis and the stipule-like decurrent appendages on both sides of the bracts, noted especially in the section *Geissanthera*, is unique in the whole of the monopodial alliance.

The genus is closely related to *Taeniophyllum*, subgenus *Codonosepalum*, but it is characterized by 4 distinct pollinia.

Microtatorchis aristata Garay, *nom. nov.*

Basionym: *Taeniophyllum bracteatum* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 5: 168, 1937, not *Microtatorchis bracteata* Schltr.

Microtatorchis Paife (Drake del Castillo) Garay, *comb. nov.*

Basionym: *Taeniophyllum Paife* Drake del Castillo, Ill. Fl. Ins. Mar. Pacif. 311, 1892.

Microtatorchis Schlechteri Garay, *nom. nov.*

Basionym: *Microtatorchis fasciola* Schltr. in Engl. Bot. Jahrb. 39: 88: 1906, not Schltr. 1905.

Neobathiea Schltr. in Fedde Rep. Beih. 33: 369, March 20, 1925.

Type: *Aëranthes Perrieri* Schltr.

Characterized by a short column with a cleft clinandrium. Rostellum short. Pollinia 2, globose, attached directly to separate viscidia without a well-defined stipe. Lip with a wide opening to the long spur with which the main disc is movably articulate.

Neobathiea Grandidieriana (Rchb.f.) Garay, *comb. nov.*

Basionym: *Aëranthus Grandidierianus* Rchb.f. in Flora 68: 381, 1885.

Syn.: *Neobathiea filicornu* Schltr. in Fedde Rep. Beih. 33: 369, 1925.

Neofinetia Hu in Rhodora 27: 107, 1925.

Type: *Orchis falcata* Thunb.

This generic name is not validly published according to the rules of International Code of Botanical Nomenclature for no generic description has ever been provided. It is unfortunate that plants referable to *Orchis falcata* Thunb. have been extensively used in horticulture especially in hybridization. Since this generic name cannot be validated because the characters of *Orchis falcata* coincide with that of *Holcoglossum* Schltr., the following corrections are offered to the known hybrid generic names:

Holcoglossum × Aerides	= **Holcorides**
Holcoglossum × Ascocentrum	= **Holcocentrum**
Holcoglossum × Ascocentrum × Euanthe	= **Smithara**
Holcoglossum × Ascocentrum × Rhynchostylis	= **Rumrillara**
Holcoglossom × Ascocentrum × Vanda	= **Nakamotoara**
Holcoglossum × Phalaenopsis	= **Holconopsis**
Holcoglossum × Renanthera	= **Holcanthera**
Holcoglossum × Renanthera × Rhynchostylis	= **Hueylihara**
Holcoglossum × Rhynchostylis	= **Holcostylis**
Holcoglossum × Vanda	= **Vandoglossum**

Parasarcochilus Dockr., Austral. Sarcanth. 22, Sept. 19, 1967.

Type: *Sarcochilus spathulatus* Rogers.

This genus is a synonym of *Pteroceras* Hassk.

Pennilabium J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 14: 43, Apr. 1914.
Lectotype: *Saccolabium Angraecum* Ridl.

Characterized by the short, footless column which is more or less compressed dorsally. Rostellum elongate, prominent, bifid. Pollinia 2, entire, on long, slender, often spathulate stipe. Stigma large, transverse. Lip with a distinct spur without callosities inside. In the construction of the lip there are two types: 1, lateral lobes well-developed and the midlobe reduced to a small fleshy lobe; 2, lateral lobes much reduced, may be represented only by small auricle-like lobes; midlobe very prominent, fleshy and solid.

Inflorescence elongate, racemose, bifarious, with somewhat thickened and complanate rachis.

Pennilabium confusum (Ames) Garay, *comb. nov.*
Basionym: *Saccolabium confusum* Ames in Phil. Journ. Sci. Bot. 8: 435, 1913.
Pennilabium fimbriatum (Ridl.) Garay, *comb. nov.*
Basionym: *Saccolabium fimbriatum* Ridl. in Journ. Str. Br. Roy. As. Soc. 54: 52, 1909.
Pennilabium luzonense (Ames) Garay, *comb. nov.*
Basionym: *Saccolabium luzonense* Ames in Phil. Journ. Sci. Bot. 8: 435, 1913.

Podochilopsis Guillaum. in Bull. Mus. Nat. Hist. Paris, ser. 2, 34: 478, 1962.
Type: *Podochilopsis dalatensis* Guillaum.

This is a synonym of *Adenoncos* Bl.

Pomatocalpa Breda, Gen. et Sp. Orch. et Ascl. Fasc. 3: t. 15, Aug. 15, 1829.
Type: *Pomatocalpa spicatum* Breda.

Characterized by a short, footless column to which the fleshy lip is immovably adnate. Rostellum bifid, hammer-shaped. Pollinia 2, each split into unequal halves on a slender stipe. Lip more or less bucket-shaped with a distinct tongue or valvate callus, often forked at the tip projecting from the backwall diagonally across toward the apex.

Pomatocalpa bambusarum (King & Pantl.) Garay, *comb. nov.*

Basionym: *Sarcanthus bambusarum* King & Pantl. in Journ. As. Soc. Bengal 65: 123, 1896.

Pomatocalpa falciforme (Tixier) Garay, *comb. nov.*

Basionym: *Camarotis falciformis* Tixier in Bull. Mus. Nat. Hist. Paris, ser. 2, 36: 162, 1964.

Syn.: *Pomatocalpa laoticum* Seidenf. in Nat. Hist. Bull. Siam Soc. 23: 568, 1970.

Porphyrodesme Schltr. in Fedde Rep. Beih. 1: 982, Sept. 1, 1913.

Type: *Saccolabium porphyrodesme* Schltr.

Characterized by a short footless column with a well-developed rostellum which is more or less sigmoid with its bifid apex turning suddenly upward. The stigma is small, completely hidden at the base under the rostellum. Pollinia 2, more or less unequally cleft on a linear stipe. Lip firmly adnate to base of column, bucket-shaped, laterally compressed with the lateral lobes arcuately spreading, but coming together so as to leave only a narrow slit for the entrance to the spur.

These peculiar characters are obviously closely connected with the pollinating mechanisms, and have been described in detail by Ridley for *Renanthera elongata* Lindl. and *Dendrocolla minima* Ridl. *Renanthera sarcanthoides* J.J.Sm. is *Porphyrodesme papuana* Schltr.

It is possible that *Renanthera moluccana* Bl. also belongs here.

Porphyrodesme elongata (Bl.) Garay, *comb. nov.*

Basionym: *Aërides elongata* Bl., Bijdr. 8: 367, 1825.

Porphyrodesme Hewittii (Ames) Garay, *comb. nov.*

Basionym: *Thrixspermum Hewittii* Ames in Journ. Str. Br. Roy. As. Soc. Sp. No. 194, 1921.

Syn.: *Dendrocolla minima* Ridl. in Journ. Str. Br. Roy. As. Soc. 50: 139, 1908, not Blume 1825.

Porrorhachis Garay, *gen. nov.*

Type: *Saccolabium galbinum* J.J.Sm.

Etymology: *porrho-* = forward and *rhachis* = rachis, in reference to the position of the inflorescences which are inserted at a right angle to the main stem.

Sepalum posticum cucullatum, incurvum; sepala lateralia valde diversa, parallela, labello adpressa. Petala multo minora, parallela. Labellum carnosum, immobile, cum ovario angulum subrectum formans, angustum, excavatum, lateraliter compressum, ecalcaratum. Columna humilis, inclinata, apoda, semiteres. Clinandrium emarginatum. Rostellum valde abbreviatum, bidentatum. Stigma magnum, faciem inferiorem columnae fere omnino occupans, suborbiculare. Pollinia 2, globosa, indivisa, esulcata, stipiti late orbiculari-rhombeo affixa; glandula parva, suborbicularis.

Herbae epiphyticae, satis parvae; caulibus elongatis, foliosis; foliis rigidis, patentissimis; inflorescentiis axillaribus, simplicibus, laxe multifloris; floribus minutis, flavescentibus.

In general appearance as well as in the floral structures the characters of this new genus appear to be similar to those of the genus *Micropera* Lindl. However, the deeply cleft clinandrium with the short, bidentate rostellum, together with the undivided pollinia on short, semirotund stipes amply differentiates it from the vegetatively much larger plants of *Micropera*.

Porrorhachis galbina (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Saccolabium galbinum* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 26: 97, 1918.

Porrorhachis macrosepala (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus macrosepalus* Schltr. in Fedde Rep. 10: 203, 1911.

Pteroceras Hassk. in Tijdsch. Nat. Ges. 9: 142, 1842.
Type: *Pteroceras radicans* Hassk.

Characterized by the short column with a long column-foot to which the lip is movably attached. Pollinia 2, each more or less divided in subequal halves on a distinct stipe. Lip usually continuous in position with the column-foot, saccate or calcarate with distinct lateral lobes and an abbreviated midlobe which is never replicate. Spur or sac without callosities, but the anterior wall at times may be quite fleshy as is observable in longitudinal sections.

Parasarcochilus Dockr., which is referable here, is a clear example of the semantics previously mentioned regarding the number of pollinia. Dockrill states that *Parasarcochilus* "superficially . . . . closely resembles *Pteroceras*, but members of this latter genus have only two pollinia, whereas those of the new genus have four", that is "Pollinia 4 in 2 closely appressed pairs (members of the pairs unequal)". Yet in the original description of *Pteroceras* we find "massae pollinis 4" which are clearly illustrated on the original drawings of *Pteroceras radicans* which I have studied and which is partly reproduced by Reichenbach in Xenia Orchidacea 2: t. 140, 1867, under the name of *Sarcochilus teres* (Bl.) Rchb.f.

It should be noted that *Parasarcochilus Weinthalii* (Bail.) Dockr. is a true *Sarcochilus*. It has neither a spur nor a sac to the lip. Apparently the elongate lateral lobes of the lip must have served as the reason for the ill-fated transfer.

Pteroceras has only recently been recognized through

the efforts of Holttum who published a valuable discussion on its distinction from *Sarcochilus* R.Br. Unfortunately Holttum did not recognize the generic characters of *Grosourdya* Rchb.f. and *Ascochilus* Ridl., when he removed the true *Sarcochilus* species of this heterogeneous complex. With the exclusion of *Grosourdya* and *Ascochilus*, the genus *Pteroceras* becomes a well-defined genus which ultimately will be broken up into three or four distinct sections based on the vegetative aspects and inflorescence types.

It is probable that *Pteroceras alatum* (Holtt.) Holtt., *P. Berkeleyi* (Rchb.f.) Holttum, *P. membraniferum* (Carr) Garay and *P. longicalcareum* (Ames & Rolfe) Garay in the future may be elevated into a separate genus, for they differ from the rest of the members in having all of the flowers open simultaneously. This latter group in many ways is much closer to the genus *Macropodanthus* L.O.Wms. than to *Pteroceras*, but the structural differences in the column and the lip at this point sufficiently keeps them apart.

Pteroceras chrysanthum (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus chrysanthus* Schltr. in Fedde Rep. Beih. 1: 966, 1913.

Pteroceras fragrans (Ridl.) Garay, *comb. nov.*

Basionym: *Sarcochilus fragrans* Ridl. in Journ. Str. Br. Roy. As. Soc. 49: 38, 1907.

Pteroceras hirticalcar (Dockr.) Garay, *comb. nov.*

Basionym: *Parasarcochilus hirticalcar* Dockr., Austral. Sarcanth. 23, 1967.

Pteroceras iboensis (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus iboensis* Schltr. in Fedde Rep. Beih. 1: 966, 1913.

Pteroceras longicalcareum (Ames & Rolfe) Garay, *comb. nov.*

Basionym: *Sarcochilus longicalcareus* Ames & Rolfe in Ames, Orchid. 5: 212, 1915.

Pteroceras membraniferum (Carr) Garay, *comb. nov.*

Basionym: *Sarcochilus membraniferus* Carr in Gard. Bull. Str. Settl. 8: 121, 1935.

Pteroceras odoratum (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus odoratus* Schltr. in Fedde Rep. Beih. 1: 965, 1913.

Pteroceras Phalaenopsis (Schltr.) Garay, *comb. nov.*

Basionym: *Sarcochilus Phalaenopsis* Schltr. in Fedde Rep. 10: 203, 1911.

Pteroceras philippinense (Ames) Garay, *comb. nov.*

Basionym: *Thrixspermum philippinense* Ames in Phil. Journ. Sci. 8: 437, 1913.

Syn.: *Sarcochilus Hubbardianus* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 5: 32, 1937.

Pteroceras singuliflorum Garay, *nom. nov.*

Basionym: *Sarcochilus uniflorus* Schltr. in Fedde Rep. Beih. 1: 965, 1913, not *Pteroceras uniflorum* Tixier 1967.

Pteroceras spathibrachiatum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcochilus spathibrachiatus* J.J.Sm. in Blumea 5: 310, 1943.

Pteroceras spathipetalum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcochilus spathipetalus* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 3, 11: 151, 1931.

Pteroceras spathulatus (Rogers) Garay, *comb. nov.*

Basionym: *Sarcochilus spathulatus* Rogers in Trans. Roy. S. Austral. 51: 1, 1927.

Pteroceras Vriesii (Ridl.) Garay, *comb. nov.*

Basionym: *Sarcochilus Vriesii* Ridl. in Journ. Linn. Soc. Bot. 30: 297, 1891.

Rhinerrhiza Rupp in Vict. Nat. 67: 206, Feb. 1951.

Type: *Sarcochilus divitiflorus* F. Muell. ex Benth.

Characterized by rough-papillose roots and leaves which are harsh and dry in texture. Column short with an elongate foot set at an acute angle to it. Rostellum bidentate. Pollinia 2, split in more or less equal halves on a short stipe. Lip articulate with column-foot. Sepals and petals long filiform-caudate.

Rhinerrhiza Freemanii (Rchb.f.) Garay, *comb. nov.*

Basionym: *Thrixspermum Freemanii* Rchb.f. in Gard. Chron. n.s. 7: 750, 1877.

Syn.: *Sarcochilus Freemanii* Rchb.f. in Gard. Chron. n.s. 7: 750, 1877.

Rhipidoglossum Schltr. in Beih. Bot. Centralbl. 36, pt. 2: 80, Apr. 30, 1918.

Lectotype: *Aëranthus xanthopollinius* Rchb.f. [Summerhayes in Blumea, Suppl. 1: 80, June 29, 1937.]

Characterized by a short column with large, truncate clinandrium. Rostellum porrect. Pollinia 2, with separate stipes and viscidia. Lateral sepals and the almost orbicular petals are adnate to short column-foot which is continuous with, and almost indistinguishable from, the base of the lip. Lip usually broader than long and very obtuse or rounded.

Rhipidoglossum cuneatum (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe cuneata* Summerh. in Kew Bull. 14: 141, 1960.

Rhipidoglossum curvatum (Rolfe) Garay, *comb. nov.*

Basionym: *Mystacidium curvatum* Rolfe in Dyer, Fl. Trop. Afr. 7: 174, 1897.

Rhipidoglossum kamerunense (Schltr.) Garay, *comb. nov.*

Basionym: *Angraecum kamerunense* Schltr. in Engl. Bot. Jahrb. 38: 161, 1906.

Rhipidoglossum Mildbraedii (Krzl.) Garay, *comb. nov.*

Basionym: *Mystacidium Mildbraedii* Krzl. in Engl. Bot. Jahrb. 43: 342, 1909.

Rhipidoglossum ovale (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe ovalis* Summerh. in Kew Bull. 16: 313, 1962.

Rhipidoglossum polydactylum (Krzl.) Garay, *comb. nov.*

Basionym: *Listrostachys polydactyla* Krzl. in Engl. Bot. Jahrb. 51: 394, 1914.

Rhipidoglossum pulchellum (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe pulchella* Summerh. in Bot. Mus. Leafl. Harv. Univ. 12: 103, 1945.

Rhipidoglossum pulchellum var. **geniculatum** (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe pulchella* var. *geniculata* Summerh. in Bot. Mus. Leafl. Harv. Univ. 12: 105, 1945.

Rhipidoglossum Schimperianum (A. Rich.) Garay, *comb. nov.*

Basionym: *Dendrobium Schimperianum* A. Rich., Tent. Fl. Abyss. 2: 282, 1851.

Rhipidoglossum Stolzii (Schltr.) Garay, *comb. nov.*

Basionym: *Diaphananthe Stolzii* Schltr. in Engl. Bot. Jahrb. 53: 600, 1915.

Rhipidoglossum subsimplex (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe subsimplex* Summerh. in Bot. Mus. Leafl. Harv. Univ. 12: 107, 1945.

Rhipidoglossum tenerrimum (Krzl.) Garay, *comb. nov.*

Basionym: *Listrostachys tenerrima* Krzl. in Viertelj. Nat. Ges. Zürich 68: 424, 1923.

Rhipidoglossum tenuicalcar (Summerh.) Garay, *comb. nov.*

Basionym: *Diaphananthe tenuicalcar* Summerh. in Bot. Mus. Leafl. Harv. Univ. 12: 109, 1945.

Rhipidoglossum ugandense (Rendle) Garay, *comb. nov.*

Basionym: *Mystacidium ugandense* Rendle in Journ. Linn. Soc. Bot. 37: 220, 1905.

Robiquetia Gaud. in Freyc. Voy. Bot. 426, Sept. 1829.

Type: *Robiquetia ascendens* Gaud.

Characterized by a short, footless column with a broad, well-developed, bifid rostellum. Pollinia 2, notched on a more or less spathulate or often uncinate, seldom hamate stipe; viscidium large. The pollinia commonly reclining on the rostellum into the clinandrium. Lip spurred which occasionally may have some callosities or scales along either the back or front wall.

It differs from *Malleola* primarily in the shape of the stipe of the pollinia.

Robiquetia brevifolia (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium brevifolium* Lindl., Gen. and Sp. Orch. Pl. 225, 1833.

Robiquetia cerina (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium cerinum* Rchb.f. in Gard. Chron. ser. 3, 4: 206, 1888.

Syn. *Malleola Merrillii* Ames, Orchid 5: 236, 1915.

Robiquetia Merrillii (Ames) Ames, Orchid. 7: 123, 1922.

Robiquetia constricta (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium constrictum* Rchb.f., Otia Bot. Hamb. pt. 1: 52, 1878.

Robiquetia flexa (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium flexum* Rchb.f. in Gard. Chron. n.s. 18: 520, 1882.

Robiquetia gracilis (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium gracile* Lindl., Gen. and Sp. Orch. Pl. 225, 1833.

Syn.: *Malleola gracilis* (Lindl.) Schltr. in Fedde Rep. Beih. 1: 981, 1913.

Robiquetia Graeffei (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium Graeffei* Rchb.f. in Gard. Chron. n.s. 16: 716, 1881.

Syn.: *Malleola Graffei* (Rchb.f.) P.F. Hunt in Kew Bull. 24: 99, 1970.

Robiquetia mimus (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium mimus* Rchb.f. in Gard. Chron. n.s. 9: 266, 1878.

Syn.: *Malleola mimus* (Rchb.f.) P.F.Hunt in Kew Bull. 24: 98, 1970.

Robiquetia pachyphylla (Rchb.f.) Garay, *comb. nov.*

Basionym: *Aërides pachyphylla* Rchb.f. in Gard. Chron. n.s. 14: 231, 1880.

Syn.: *Saccolabium longicalcaratum* Rolfe in Kew Bull. 186, 1894.
Saccolabium Fuerstenbergianum Schltr. in Orchis 6: 68, 1912.
Robiquetia Fuerstenbergiana (Schltr.) Schltr. in Fedde Rep. Beih. 1: 983, 1913.

Robiquetia rosea (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium roseum* Lindl., Gen. and Sp. Orch. Pl. 225, 1833.

Syn.: *Malleola rosea* (Lindl.) Schltr. in Fedde Rep. Beih. 1: 981, 1913.

Robiquetia Woodfordii (Rolfe) Garay, *comb. nov.*

Basionym: *Saccolabium Woodfordii* Rolfe in Kew Bull. 131, 1907.

Syn.: *Malleola Woodfordii* (Rolfe) P.F.Hunt in Kew. Bull. 24: 99, 1970.

Saccolabiopsis J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 26: 93, Feb. 1918.

Type: *Saccolabiopsis Bakhuizenii* J.J.Sm.

Characterized by the minute, thin flowers. Sepals and petals ringent. Lip firmly adnate to base of column, saccate or spurred with wide, broad opening, without any appendages inside. Column small, cylindric, footless.

Pollinia 2, each completely divided into very unequal halves on a long, slender stipe.

Plants usually small with slender inflorescences. Rachis loosely many-flowered, racemose or rarely subpaniculate.

Saccolabiopsis Gillespiei (L.O.Wms.) Garay, *comb. nov.*

Basionym: *Saccolabium Gillespiei* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 5: 139, 1938.

Saccolabiopsis pumila Garay, *nom. nov.*

Basionym: *Saccolabium pumilum* Ridl. in Trans. Linn. Soc. Bot. ser. 2, 9: 204, 1916, not Hayata 1906.

Saccolabiopsis rectifolia (Dockr.) Garay, *comb. nov.*

Basionym: *Robiquetia rectifolia* Dockr., Austral. Sarcanth. 8, 1967.

Saccolabiopsis tenella (Ames) Garay, *comb. nov.*

Basionym: *Saccolabium tenellum* Ames, Orchid. 6: 308, 1920.

Sarcanthopsis Garay, *gen. nov.*

Type: *Sarcanthus nagarensis* Rchb.f.

Etymology: *Sarcanthus*= a generic name and *-opsis* = like, in reference to the superficial similarity in the appearance of the flowers to those in the formerly recognized genus *Sarcanthus*.

Sepala petalaque, patula, libera, similia, carnosa. Labellum basi columnae adnatum, semiapertum seu ringens, intus dorsaliter per totam longitudinem papuloso incrassatum, quasi pulvinatum, angulato-gibbosum. Columna cylindrica, apoda. Clinandrium humile. Stigma mediocre, suborbiculare. Rostellum abrupte arrectum, bilobum. Pollinia 2, globosa unumquidque inaequaliter fissa, stipiti lineari affixa; glandula magna.

Herbae epiphyticae, metrales vel ultrae altae; caulibus erectis, foliosis; foliis distichis, carnosis; inflorescentiis robustis, erectis, axillaribus, paniculatis, multifloris.

It differs from *Cleisostoma* Bl. (*Sarcanthus* Lindl.) in the rotuliform floral segments, in the semiopen, gaping lip with a large, cushion-like, swollen backwall. *Vandop-*

sis Pfitz., to which the species have been previously referred, differs in the absence of the cushion-like swollen backwall to the lip and in the structure of the pollinia which are transversely oblong-ovoid and are adnate at a right angle in subequal pairs to the broadly oblong to subquadrate stipe. Also the flowers always appear to be much larger.

Sarcanthopsis curvata (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Vandopsis curvata* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 13: 73, 1914.

Sarcanthopsis nagarensis (Rchb.f.) Garay, *comb. nov.*
Basionym: *Sarcanthus nagarensis* Rchb.f. in Seem., Fl. Vit. 298, 1868.

Sarcanthopsis pantherina (J.J.Sm.) Garay, *comb. nov.*
Basionym: *Vandopsis pantherina* J.J.Sm. in Nova Guinea 14 Bot., pt. 3: 493, 1929.

Sarcanthopsis praealta (Rchb.) Garay, *comb. nov.*
Basionym: *Sarcanthus praealtus* Rchb.f. in Bot. Centralbl. 28: 344, 1886.

Sarcanthopsis Quaifei (Rolfe) Garay, *comb. nov.*
Basionym: *Stauropsis Quaifei* Rolfe in Kew Bull. 64, 1900.

Sarcanthopsis Warocqueana (Rolfe) Garay, *comb. nov.*
Basionym: *Stauropsis Warocqueana* Rolfe in Lindenia 7: 65, 1892.

Sarcanthopsis Woodfordii (Rolfe) Garay, *comb. nov.*
Basionym: *Stauropsis Woodfordii* Rolfe in Kew Bull. 72: 1908.

Sarcanthus Lindl. in Bot. Reg. 10: sub t. 817, 1824.
Type: *Epidendrum praemorsum* Roxb.

This genus either should replace *Acampe* to which *E. praemorsum* has been referred or *Acampe* must be conserved. The latter choice is recommended here for members of the genus *Acampe* have been used in horticulture in hybridization programs. The transfer of the type species to *Sarcanthus praemorsus* has been published by Lindley a year earlier in J. Donn, Hortus Cantabrigiensis ed. 10, p. 335, 1823.

Sarcanthus Lindl., Coll. Bot. t. 39B, Jan. 1826, not Lindl. 1824.

Type: *Sarcanthus rostratus* Lindl.

This generic name is a later homonym, hence illegitimate. It is a synonym of the earlier *Cleisostoma* Bl.

Sarcoglyphis Garay, *gen. nov.*

Type: *Sarcanthus mirabilis* Rchb.f.

Etymology: *sarx*= flesh and *glyphon*= carving, in reference to the more or less prominent, fleshy rostellum which sits on top of the clinandrium like a carved ornament upon which the pollinia recline so as to be in a dorsal position.

Sepala petalaque libera, aperta, subsimilia, nisi petala minora vel angustiora. Labellum lobatum, calcaratum, basi columnae adnatum, intus dorsaliter callosum. Columna humilis, apoda, plus minusve cylindrica. Clinandrium humile. Rostellum carnosum, valde evolutum, arcuatum, apice acutum. Stigma suborbiculare sub rostello. Pollinia 4, distincta, globosa, per caudiculam prominentem stipiti lineari-spathulati angulatim affixa; glandula minuta, subglobosa. Anthera rostrata.

Herbae epiphyticae; caulibus satis abbreviatis, foliosis; foliis distichis, carnosis, apice inaequalibus; inflorentiis axillaribus, pendulis, racemosis, laxe multifloris, basin versus infra folia natis.

This new genus differs from *Cleisostoma* Bl. (*Sarcanthus* Lindl.) in the shape of the fleshy rostellum upon which the pollinia archingly recline; the pollinia are distinctly 4, each of which is attached to the slender stipe through a thin caudicle at a right angle. *Cleisostoma* has an entirely different rostellum and the pollinia are 2 in number, each separated into unequal halves.

Sarcoglyphis flava (Hook.f.) Garay, *comb. nov.*

Basionym: *Saccolabium flavum* Hook.f., Fl. Brit. Ind. 6: 58, 1890.

Sarcoglyphis lilacina (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus lilacinus* J.J.Sm. in Bull. Dep. Agric. Ind. Neerl. 5: 27, 1907.

Sarcoglyphis mirabilis (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus mirabilis* Rchb.f. in Gard. Chron. n.s. 10: 300, 1878.

Syn.: *Sarcanthus Gilberti* Hook.f., Icon. Pl. 24: t. 2334, 1894.

Sarcanthus Smithianus Kerr in Journ. Siam Soc. Nat. Hist. Suppl. 9: 239, 1933.

Sarcanthus vientianensis Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 30: 461, 1958.

Sarcanthus Tixieri Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 35: 650, 1963.

Sarcophyton Garay, *gen. nov.*

Type: *Cleisostoma crassifolium* Lindl. & Paxt.

Etymology: *sarx* = flesh and *phyton* = plant, in reference to the excessively fleshy nature of the plants in all of their parts.

Sepala libera, subaequalia. Sepalum posticum erectum, sepala lateralia plus minusve reflexa. Petala minora, libera, plus minusve reflexa. Labellum basi columnae adnatum, lobatum, calcaratum; lobis lateralibus erectis, dentiformibus, lobo intermedio recurvo, valde ruguloso incrassato, calcare cylindrico, pendulo, eseptato, orificio callis 2, sese tengentibus ornato. Columna humilis, apoda. Clinandrium humile. Stigma satis magnum, orbiculare. Rostellum abbreviatum, bidentatum. Pollinia 4, distincta, globosa, stipiti lineari affixa; glandula minuta.

Herbae epiphyticae, validae, crasse carnosae; caulibus robustis paucifoliatis; foliis crasse coriaceis vel carnosis, conduplicatis, arcuatis; inflorescentiis usque ad vel supra metrales, longe pedunculatis, supra paniculatis multifloris.

The flowers, especially the shape of the lip, are reminiscent of certain *Acampe* species, such as *A. papillosa* (Lindl.) Lindl. and *A. ochracea* (Lindl.) Hochr. The

genus *Acampe*, however, is characterized by the lack of callosities in the lip and by the two unequally split, globose pollinia. *Sarcophyton* differs from *Cleisostoma* Bl. (*Sarcanthus* Lindl.) in the shape of the column and in the insertion of the lip as well as in the distinctly 4 globose pollinia on the slender stipe.

Sarcophyton crassifolium (Lindl. & Paxt.) Garay, *comb. nov.*

Basionym: *Cleisostoma crassifolium* Lindl. & Paxt. in Paxt., Fl. Gard. 3: 125, 1852.

Sarcophyton pachyphyllum (Ames) Garay, *comb. nov.*

Basionym: *Sarcanthus pachyphyllus* Ames, Orchid. 5: 250, 1915.

Sarcophyton taiwanianum (Hayata) Garay, *comb. nov.*

Basionym: *Sarcanthus taiwanianus* Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 30: 337, 1911.

Schoenorchis Bl., Bijdr. 6: t. 3, June 1825.

Type: *Schoenorchis juncifolia* Bl.

Characterized by the short, footless column to which the lip is firmly jointed at the base. Stigma at base of column, marginate. Rostellum prominent, long acicular, distinctly bilobed, arrect, *i.e.*, by an abrupt turn perpendicular and parallel with the fairly deep clinandrium. Pollinia 2, divided into more or less unequal halves on a rather slender stipe which is movably jointed approximately at the middle with the conspicuous, scale-like viscidium. Lip is saccate or spurred without inside callosities; but the disc or lamina is very fleshy.

Schoenorchis aurea (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium aureum* Ridl. in Journ. Str. Br. Roy. As. Soc. 49: 35, 1907.

Schoenorchis chrysantha (Alston) Garay, *comb. nov.*

Basionym: *Saccolabium chrysanthum* Alston in Trimen, Handb. Fl. Ceylon 6, Suppl. 277, 1931.

Schoenorchis Jerdoniana (Wight) Garay, *comb. nov.*

Basionym: *Taeniophyllum Jerdonianum* Wight. Ic. Pl. Ind. Orient. 5: 22, t. 1756, 1851.

Schoenorchis pachyglossa (Lindl.) Garay, *comb. nov.*

Basionym: *Saccolabium pachyglossum* Lindl. in Journ. Linn. Soc. 3: 34, 1858.

Schoenorchis tortifolia (Jayaw.) Garay, *comb. nov.*

Basionym: *Saccolabium tortifolium* Jayaw. in Bot. Mus. Leafl. Harv. Univ. 20: 111, 1963.

Seidenfadenia Garay, *gen. nov.*

Type: *Aërides mitrata* Rchb.f.

Etymology: In honor of Dr. Gunnar Seidenfaden, career diplomat and scientist whose recently published four-volume treatise on the Orchids of Thailand is a storehouse of information.

Sepala petalaque libera, subaequalia plus minusve similia, patentia vel reflexa. Labellum basi columnae continuum, lobatum; lobis lateralibus minutis, corniculatis, lobo intermedio prominente planiusculo; calcar lateraliter compressum, a latere viso semilunatum, obtusum, intus ecallosum, sed utrinque carina a pariete superiore antice oblique fundum versus descendente donatum. Columna humilis, crassa, basin versus sensim dilatata, pedem obscurum formans. Clinandrium dorsale. Stigma reniforme ad basin columnae. Rostellum erectum, bidentatum, carinatim elevatum. Pollinia 2, sulcata, stipiti lineari-spathulati affixa; glandula prominens.

Plantae epiphyticae; caulibus satis abbreviatis, vaginis foliorum approximatis omnino obtectis; foliis articulatis, semiteretibus, sulcatis; inflorescentiis axillaribus, pendulis, laxe racemosis, multifloris, basin versus infra folia natis.

It is hard to understand why this plant was referred to the genus *Aërides* by Reichenbach; the only vague resemblance is in the saccate spur which is projecting obliquely forward under the blade of the lip. The whole resemblance stops here. In the adnation of the column and in the pollinia it is reminiscent of the characters of *Rhynchostylis*, especially the group Schlechter called

Anota, but the habit of growth, the clinandrium, stigma and the special shape and position of the rostellum are widely different in this new genus. As a matter of fact the crest-shaped rostellum which projects across the clinandrium and protrudes dorsally on the column is a very unique feature, and is analogous to the saddle-shaped rostellum in *Sarcoglyphis* which also has the inflorescences borne above the base, but below the leaves. In *Sarcoglyphis* the pollinia are distinctly 4, and are adnate to the slender stipe by distinct caudicles.

Seidenfadenia mitrata (Rchb.f.) Garay, *comb. nov.*

Basionym: *Aërides mitrata* Rchb.f. in Bot. Zeit. 22: 415, 1864.

Smitinandia Holttum in Gard. Bull. Singap. 25: 105, Oct. 4, 1969.

Type: *Saccolabium micranthum* Lindl.

Characterized by the short, cylindrical column, which is somewhat broadened at the base, but not truly forming a foot, to which the lip is firmly jointed. Stigma small under the short rostellum. Pollinia 2, each divided into unequal halves on a short, broad, toward the apex somewhat dilated stipe with large glands. Lip spurred without a backward callus, but the entrance is closed by a transverse ridge situated at the base of the lamina of the lip.

Smitinandia Helferi (Hook.f.) Garay, *comb. nov.*

Basionym: *Saccolabium Helferi* Hook.f., Fl. Brit. Ind. 6: 57, 1890.

Syn.: *Saccolabium humile* Ridl. in Journ. Str. Br. Roy. As. Soc. 59: 198, 1911.

Smitinandia humilis (Ridl.) Holttum in Gard. Bull. Singap. 25: 106, 1969.

Smitinandia selebensis (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Sarcanthus selebensis* J.J.Sm. in Svensk. Bot. Tijdrskr. 20: 480, 1926.

Stereochilus Lindl. in Journ. Linn. Soc. 3: 38, Aug. 20, 1958.

Type: *Stereochilus hirtus* Lindl.

Characterized by the rather long, erect column without a foot. Rostellum porrect, long, subulate. Pollinia 4, more or less ovoid, distinct on slender stipe with a minute gland. Lip firmly adnate to base of column. Lateral sepals adnate to the sides of the lip.

It differs from *Micropera* which also is characterized by the lateral sepals being decurrent on both sides of the lip, in the long column, in the differently shaped rostellum and in the number and structure of the pollinia. From *Cleisostoma* Bl. (*Sarcanthus* Lindl.) in which it has been included by several students, *Stereochilus* differs in the elongate column, in the proboscis-like rostellum and in the four distinct pollinia.

Stereochilus dalatensis (Guillaum.) Garay, *comb. nov.*

Basionym: *Sarcanthus dalatensis* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 27: 397, 1955.

Syn.: *Sarcanthus crassifolius* Rolfe ex Downie in Kew Bull. 392, 1925, not J.J.Smith 1912.

Stereochilus erinaceus (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus erinaceus* Rchb.f. in Bot. Zeit. 22: 298, 1864.

Stereochilus laxus (Rchb.f.) Garay, *comb. nov.*

Basionym: *Sarcanthus laxus* Rchb.f. in Bot. Zeit. 24: 378, 1866.

Stereochilus ringens (Rchb.f.) Garay, *comb. nov.*

Basionym: *Cleisostoma ringens* Rchb.f.) in Gard. Chron. ser. 3, 4: 724, 1888.

Syn.: *Stereochilus Wattii* King & Pantl. in Journ. As. Soc. Bengal 66: 595, 1897.

Taeniophyllum Bl. Bijdr. 6: t. 3, June 1825.

Lectotype: *Taeniophyllum obtusum* Bl.

Characterized by the leafless habit. Column short, footless. Lip adnate to base of column, saccate or calcarate without any callosities. Pollinia 4, distinct on a slender stipe with a large viscidium.

I believe that the genus *Taeniophyllum* is composed

of very different and heteregous elements, judging from the structure of the pollinia and the shape of the column. A monographic revision undoubtedly will find correlated criteria with such pollinaria where the stipe is suddenly expanded into a receptacle-like cup containing the four ovoid pollinia.

The genus must be typified by *T. obtusum* Bl. to which the generic description applies. *Taeniophyllum fornicatum* Bl., although never described, is validly published through a floral analysis in Blume's Tabellen, fig. 70. It has been redescribed and illustrated by J.J.Smith under *T. biocellatum* J.J.Sm.

Taeniophyllum gracile (Rolfe) Garay, *comb. nov.*

Basionym: *Sarcochilus gracilis* Rolfe in Journ. Linn. Soc. Bot. 39: 176, 1909.

Syn.: *Taeniophyllum vitiense* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 5: 141, 1938.

Thrixspermum Lour., Fl. Cochinch. 2: 519, Sept. 1790.

Type: *Thrixspermum Centipeda* Lour.

Characterized by the short, stout column with a long column-foot upon which the column-wings, when present, are decurrent. Pollinia 2, linear-oblong, each divided into unequal halves, the posterior one of which is very small, on rather a small stipe with a small gland. Inflorescence either bifarious or quaquaversal, racemose with one to few fugacious flowers produced in succession.

Thrixspermum ancoriferum (Guillaum.) Garay, *comb. nov.*

Basionym: *Cleisostoma ancoriferum* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 34: 410, 1962.

Syn.: *Cleisostoma aciliata* Guillaum. & Tixier in Bull. Mus. Hist. Nat. Paris, ser. 2, 36: 398, 1964.

Thrixspermum annamense (Guillaum.) Garay, *comb. nov.*

Basionym: *Ascochilus annamensis* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 33: 333, 1961.

Thrixspermum clavatum (Koenig) Garay, *comb. nov.*

Basionym: *Epideudrum clavatum* Koenig in Retz, Observ. Bot. 6: 50, 1791.

Thrixspermum laurisilvaticum (Fukuyama) Garay, *comb. nov.*

Basionym: *Sarcochilus laurisilvaticus* Fukuyama in Bot. Mag. Tokyo 52: 26, 1938.

Thrixspermum pusillum (Guillaum.) Garay, *comb. nov.*

Basionym: *Ascochilus pusillus* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 29: 347, 1957.

Trachoma Garay, *gen. nov.*

Type: *Dendrocolla rhopalorhachis* Rchb.f.

Etymology: *Trachoma*= roughness, in reference to the short inflorescence which is quite rough because of the remnants of densely packed bracts.

Perigonii phylla libera, patentia. Sepala quam petala longiora, subsimilia. Labellum carnosum, lateraliter plus minusve compressum, calceoliforme, interdum subcalcaratum vel saccatum, intus ecallosum, antice tuberculoso vel pulvinato incrassatum, basi columnae adnatum, non articulatum. Columna humilis, crassa, apoda. Clinandrium humile. Rostellum erectum, bifidum, breve. Stigma magnum, suborbiculare. Pollinia 2, globosa, integra, ut plurimum breviter obscureque sulcata, stipiti lineari affixa; glandula valde evoluta.

Herbae epiphyticae; caulibus plus minusve elongatis, foliosis; foliis satis coriaceis, lineari-falcatis, distichis; inflorescentiis abbreviatis breviter pedunculatis, rachide congestis, distincte incrassatis, paucifloris; floribus tenuibus, satis fugaceis.

It differs from *Saccolabium* Bl. in the footless column, in the short erect rostellum and in the robust habit. *Tuberolabium* Yamamoto which closely resembles *Trachoma*, differs in having a column-foot to which the lateral sepals are adnate obliquely and in the elongate, multiflowered inflorescences with alate-ribbed rachis.

Trachoma brevirhachis (L.O.Wms.) Garay, *comb.nov.*

Basionym: *Saccolabium brevirhachis* L.O.Wms. in Bot. Mus. Leafl. Harv. Univ. 6: 109, 1938.

Trachoma celebicum (Schltr.) Garay, *comb. nov.*

Basionym: *Saccolabium celebicum* Schltr. in Fedde Rep. 10: 198, 1911.

Trachoma coarctatum (King & Pantl.) Garay, *comb. nov.*

Basionym: *Saccolabium coarctatum* King & Pantl. in Journ. As. Soc. Bengal 66: 592, 1897.

Trachoma guamense (Ames) Garay, *comb. nov.*

Basionym: *Saccolabium guamense* Ames in Phil. Journ. Sci. 9: 15, 1914.

Trachoma rhopalorhachis (Rchb.f.) Garay, *comb. nov.*

Basionym: *Dendrocolla rhopalorhachis* Rchb.f., Xenia Orch. 1: 124, 1858.

Syn.: *Sarcochilus brachyglottis* Hook.f., Fl. Brit. Ind. 6: 34, 1890.
Saccolabium papuanum Schltr. in Fedde Rep. Beih. 1: 978, 1913.

Trachoma subluteum (Rupp) Garay, *comb. nov.*

Basionym: *Saccolabium subluteum* Rupp in N. Queensl. Nat. 21, no. 105: 1, 1953.

Trichoglottis Bl., Bijdr. 6: t. 3, June 1825.

Type: *Trichoglottis retusa* Bl.

Characterized by the short, more or less cylindric column which may or may not be broadened somewhat at the base so as to appear to have a foot-like extension to which the lip is firmly adnate. Clinandrium shallow, often provided in front on both sides with hairy stelidia of various lengths. Pollinia 2, each divided in unequal halves on a distinct stipe. Lip firmly adnate to base of column, saccate or spurred, 3-lobed; the lateral lobes more or less fused with the basal sides of the column; from the dorsal wall of the spur or sac a narrow ligulate or tongue-shaped, movable, often hairy lamella is projecting toward the midlobe, so as to completely cover the entrance to the nectariferous cavity.

Inflorescence axillary, either fasciculate with one to

several flowers in a cluster or it may be racemose or paniculate with loosely many flowers, much exceeding the leaves. For this latter group the generic name *Staurochilus* Ridl. was proposed.

Trichoglottis rigida Bl. is very atypical in the shape of the lip and in the pollinaria, and it requires further study. However, it is not a *Sarcanthus* Lindl., now equals *Cleisostoma* Bl. to which J.J.Sm. has proposed to transfer it.

Trichoglottis brachystachya (Krzl.) Garay, *comb. nov.*

Basionym: *Cleisostoma brachystachyum* Krzl. in Ann. Nat. Hofmus. Wien 30: 62, 1916.

Trichoglottis luchuensis (Rolfe) Garay & Sweet, *comb. nov.*

Basionym: *Stauropsis luchuensis* Rolfe in Kew Bull. 131, 1907.

Syn.: *Vandopsis luchuensis* (Rolfe) Schltr. in Fedde Rep. 10: 196, 1911.

Staurochilus luchuensis (Rolfe) Fukuyama in Trans. Nat. Hist. Soc. Formosa 32: 270, 1942.

Trichoglottis odoratissima Garay, *nom. nov.*

Basionym: *Saccolabium odoratissimum* Ridl. in Sarawak Mus. Journ. 1: 37, 1912, not J.J.Smith 1905.

Trichoglottis orchidea (Koenig) Garay, *comb. nov.*

Basionym: *Epidendrum orchideum* Koenig in Retz, Observ. Bot. 6: 48, 1791.

Syn.: *Ceratochilus orchideus* (Koenig) Lindl., Gen. and Sp. Orch. Pl. 232, 1833.

Trichoglottis quadricornuta Kurz in Journ. As. Soc. Bengal 45, pt. 2: 13, 1876.

Trichoglottis triflora (Guillaum.) Garay & Seidenf., *comb. nov.*

Basionym: *Saccolabium triflorum* Guillaum. in Bull. Mus. Hist. Nat. Paris, ser. 2, 28: 239, 1956.

Tuberolabium Yamamoto in Bot. Mag. Tokyo 38: 209, Dec. 1924.

Type: *Tuberolabium kotoense* Yamamoto.

Characterized by the short column with obliquely decurrent column-foot to which the lateral sepals are adnate. Rostellum short, bifid, with a more or less de-

veloped median tooth. Pollinia 2, subglobose to ovoid, esulcate on a short rudimentary stipe. Lip conical to saccate, more or less laterally compressed, ecallose inside, the anterior wall much thickened, especially toward the apex.

Inflorescence axillary, elongate, from several- to many-flowered. Flowers all open at the same time, quaquaversal. The whole rachis is alate-ribbed.

Tuberolabium differs from *Saccolabium* Bl. in the general habit of the plants, in the short differently proportioned column, in not having an elongate rostellum, and hence in the structure of the pollinia. *Trachoma* Garay differs from *Tuberolabium* in the footless column and in the short, distinctly incrassate, more or less club-shaped, few-flowered and congested inflorescence.

It should be noted that the illustrations of the column in *Saccolabium odoratissimum* and *Saccolabium erosulum* by J.J. Smith are incorrect. *Saccolabium Quisumbingii* L.O.Wms. is identical with *Tuberolabium kotoense* Yamamoto.

Tuberolabium erosulum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Saccolabium erosulum* J.J.Sm. in Meded. Rijksh. Leiden 53: 13, 1925.

Tuberolabium Escritorii (Ames) Garay, *comb. nov.*

Basionym: *Saccolabium Escritorii* Ames, Orchid. 5: 227, 1915.

Tuberolabium odoratissimum (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Saccolabium odoratissimum* J.J.Sm., Fl. Buitenz. 6: 645, 1905.

Tuberolabium sarcochiloides (Schltr.) Garay, *comb. nov.*

Basionym: *Saccolabium sarcochiloides* Schltr. in Orchis 5: 61, 1911.

Syn.: *Saccolabium Rumphii* J.J.Sm. in Bull. Jard. Bot. Buitenz., ser. 2, 13: 44, 1914.

Saccolabium Loheri Ames, Orchid. 5: 228, 1915.

Saccolabium epichysiochilum Krzl. in Ann. Nat. Hofmus. Wien 30: 63, 1916.

Ventricularia Garay, *gen. nov.*

Type: *Saccolabium tenuicaule* Hook.f.

Etymology: *ventriculus* = belly, in reference to the inflated, belly-shaped spur of the lip.

Sepala petalaque similia, ringentia, nisi petala minora. Labellum sessile, basi columnae adnatum, non articulatum, 3-lobum, saccatum; lobis lateralibus erectis, lobo intermedio porrecto; incurvo, sacco ecalloso, intus juxta orificium utrinque piloso. Columna humilis, cylindrica, apoda, antice excavata. Stigma minutum sub rostello. Rostellum alte carinatum, antice bidentatum. Pollinia 2, ovoidea, unumquidque valde inaequaliter fissa, stipiti late triangulari-spathulati affixa; glandula minuta.

Herbae epiphyticae; caulibus elongatis, laxe foliosis; foliis linearibus; inflorescentiis axillaribus, fasciculatis, unifloris, succedaneis.

Vegetatively the plants of this genus are very similar to those of *Trichoglottis*, but florally they are very distinct; the characteristic ligula at the base of the lip is absent. In the elevated, carinate rostellum it is reminiscent of *Sarcoglyphis* Garay, but the shape of the stigma and the structure and number of pollinia are very dissimilar.

Ventricularia tenuicaulis (Hook.f.) Garay, *comb. nov.*

Basionym: *Saccolabium tenuicaule* Hook.f., Fl. Brit. Ind. 6: 64, 1890.

Uncifera tenuicaulis (Hook.f.) Holttum in Gard. Bull. 11: 292, 1947.

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THE CLAUDIUS CASE

BY

FLORIAN DEITGEN AND HANS GERD KAUER

In his essay "The Death of Claudius or Mushrooms for Murderers" (Bot. Mus. Leafl. Harvard Univ., vol. 23, no. 3, 1972, pp. 101–123), Mr. R. Gordon Wasson made a most brilliant attempt to identify the poison by means of which the Roman Emperor Tiberius Claudius was possibly poisoned. The essay inspired us to reread some of the classical texts. In doing so we came across a number of facts which argue against Mr. Wasson's theses.

These theses can be summarized as follows: Claudius was murdered with a poison mixed by Locusta and administered to him in a single mushroom or in a dish of mushrooms. Wasson identifies this poison as *Amanita phalloides*. When this poison did not seem to work, Claudius was administered a second poison which Wasson identifies as "colocynth", i.e. *Citrullus colocynthis* (L.) Schrader.

Let us first consider the first poison. Wasson's thesis that it was *A. phalloides* is based upon these three assertions:

1. The Latin word 'boleti' in Roman times designated the same group of mushrooms which since Linnaeus' time are called '*Amanitae*'. (cf. Wasson, p. 118)

2. Wasson holds that the effects of the poison as they are described by Tacitus (. . . turbaret mentem et mor-

tem differret.", Ann., XII, 66) correspond to *A. phalloides* poisoning. (cf. Wasson, p. 120)

3. In letter 95 of the Epistulae Morales Ad Lucilium by Lucius Annaeus Seneca, Wasson sees an allusion to *A. phalloides.* (cf. Wasson, p. 121)

According to the Latin dictionaries that we consulted, 'boletus' designates an edible mushroom, 'boleti' thus designating the class of edible mushrooms. In addition, the word seems to have had a special meaning. According to Menge-Güthling 'boletus' designates an edible mushroom, especially, however, a "Champignon" or a "Kaiserschwamm". According to K.E. Georges, 'boletus' is ". . . die beste Art essbarer Pilze, der Champignon . . ." R. Klotz says the word designates ". . . eine edle Sorte essbarer Pilze, Champignon." Harpers' Latin Dictionary says: "boletus, i, m., = *βωλίτης*, the best kind of mushroom, . . ." Plinius, in his Naturalis Historia, mentions 'boleti'. The text reads:

"Inter ea quae temere manduntur et boletos merito posuerim, opimi quidem hos cibi, sed immenso exemplo in crimen adductos, veneno Tiberio Claudio principi per hanc occasionem ab coniuge Agrippina dato, quo facto illa terris venenum alterum sibique ante omnes Neronem suum dedit." (Plinius, Nat. Hist., XLVI, 92, p. 358, Loeb Classical Library)

"Among the things which it is at times dangerous to eat, I would include mushrooms; although they are rich food, they have been used in an outstanding crime, for it was on the occasion when a dish of mushrooms was served to him that a poison was administered to the Emperor Tiberius Claudius by his wife Agrippina. In doing so she bestowed upon the world and, above all, upon herself another poison—her son Nero." (Transl. by Deltgen) (1)

It is quite unlikely that Plinius speaks of poisonous mushrooms in the passage quoted above. Of these, he comes to speak only in the sentences following our quotation. This is why H. O. Lenz in his "Botanik der Griechen und Römer (chapter "Familie Schwamm-

pflanzen, Fungi") translates "boletos" with "Kaiserschwämme", i.e. *Amanita caesarea*, for it is commonly assumed that these were Claudius' favored dish. When Plinius points out that mushrooms (whatever kind he may have had in mind), though being rich and choice food, may at times be dangerous to a person's health he obviously means this in an ironical sense, which proves that, at least, he must have been a humorous character. More humorous indeed than e.g. A. Forcellinus who, with reference to the above quotation from Plinius, writes in his "Totius Latinitatis Lexicon":

"Boletus i, m., genus fungi omnium optimi, sed simul maxime periculosi, ut qui facillime venenum attrahit, ut Plin. 22, 46, 4, ostendit, uovolo, boleto."

Forcellinus recognized that Plinius had not been speaking of a poisonous mushroom. But since Plinius wrote that it is dangerous to eat them, Forcellinus concluded that they must easily "attract" poison.

The assumption that the 'boleti' of the Romans are the 'Amanitae' of today is—as we see it—not sufficiently supported by the dictionaries, according to which the word 'boleti' appears to have four meanings:

1. Mushrooms quite generally.
2. Edible mushrooms, including Amanitae as well as non-Amanitae.
3. Possibly several particularly tasty edible mushrooms.
4. The two particularly tasty mushrooms *Psalliota campestris* and *Amanita caesarea*.

Also, there is no reason to assume that 'boletus' was a special term for poisonous mushrooms. This weakens the probability that in any given context the word 'boletus' might be meant to designate *A. phalloides*.

If we can trust Tacitus, Agrippina wanted Locusta to mix a poison which was to fulfill two requirements:

first it was to cause mental derangement in Claudius and then, after some time, it was to kill him. This double effect served a double purpose. Agrippina wanted to avoid having the Emperor die during the dinner, for it would have been difficult then to suppress the rumor that he had fallen victim to a plot. This would have compromised Agrippina as well as her son Nero, whom she wanted to become the future Caesar. Moreover, it would have been hardly possible for her to get rid of so many eye-witnesses. But since the dinner was perhaps the only occasion on which she was able to administer poison to her husband, she had to use a poison which would not kill immediately, i.e. during the dinner, but when the dinner was over. However, she had to prevent Claudius from taking any measures which might save him and/or make Britannicus successor to the throne instead of Nero. Therefore, the poison had to cause mental derangement in the victim. The symptoms of mental incoherence would be relatively inconspicuous, as Claudius was known to be a strong drinker. It was not unusual for the Emperor to get drunk in the course of a dinner. The symptoms of inebriation could hardly be distinguished by uninitiated guests from those of poisoning.

It seems, however, that even for Agrippina this was not an easy task. About what happened in the course of the memorable dinner Tacitus reports:

"adeoque cuncta mox pernotuere, ut temporum illorum scriptores prodiderint infusum delectabili cibo [<bo> leto] venenum, nec vim medicaminis statim intellectam, socordiane an Claudii vinolentia; simul soluta alvus subvenisse videbatur. igitur exterrita Agrippina et, quando ultima timebantur, spreta praesentium invidia provisam iam sibi Xenophontis medici conscientiam adhibet. ille tamquam nisus evomentis adiuvaret, pinnam rapido veneno inlitam faucibus eius demisse creditur, . . ." (Tacitus, Ann., XII, 67, 1–2, H. Fuchs, ed.) (2)

"The whole story came out soon afterwards. Contemporary writers inform us that the poison was poured into a tasty mushroom. The

effects were not noticed immediately, either because of the Emperor's natural sluggishness or because he was inebriated. It could also be observed that he evacuated his bowels. Agrippina became frightened. The worst was now to be feared. Braving all present obloquy, she called in the physician Xenophon, whose connivance she had already secured. He, it is believed, put a feather steeped into a rapid poison down the Emperor's throat as if he purposed to help him in his effort to vomit." (Trans. by Deltgen/Kauer)

Attention is drawn to Wasson's translation of this passage (cf. Wasson, p. 121). He translates "rapido veneno" as "deadly poison", which is definitely erroneous. It makes a significant difference whether Xenophon used merely some deadly poison or a rapidly acting one.

Tacitus explicitly states that the effects of the poison were not noticed immediately—either by the uninitiated guests, who were not supposed to notice them, or by the murderess herself, as we can see from her frightened reaction. This implies that the murderers, who knew the properties of the poison administered, were expecting immediate effects. In other words: since the first effect of the poison was to be mental confusion, they expected its symptoms to appear immediately, i.e. during the dinner. It does not imply that the expected symptoms actually did not appear. The text permits the conclusion that the symptoms were in fact there, but were superimposed by those of inebriation and thus could not be recognized with certainty by a non-expert in toxicology like Agrippina. There is no reason why we should assume that Locusta knew so little of poison making and/or the political situation of her time as to commit the professional blunder of mixing a poison which might cause an "evacuation of the bowels" or vomiting. She must have known that, should the plot fail, she might lose her life. We may therefore ascribe the "evacuation of the bowels" to the effects of alcohol. (3)

We have to examine now whether the pattern of action

of the poison administered to Claudius corresponds to the pattern of *A. phalloides* poisoning, paying special attention to symptoms and temporal sequence. In his article Wasson gives a short sketch of *A. phalloides* poisoning:

> ". . . its *véritable signature* . . . is the period of absolute quiescence that follows the ingestion of the mushrooms, a period that never lasts less than six hours, and usually ten or twelve, sometimes twenty or even forty or more. The victim goes about his affairs blissfully unaware that the fingers of death are entwining him. . . . Of a sudden the victim is gripped by appalling abdominal distress, followed by vomiting and diarrhoea foetida." (Wasson, p. 102)

The critical point is missing: there is no mention of mental derangement as the initial phase. On the contrary: the poisoned person feels quite normal; he is in full possession of his physical and mental capacities. When the first symptom occurs, it is not mental derangement but "abdominal distress, followed by vomiting and diarrhoea foetida".

The most exact and detailed description of *A. phalloides* poisoning is found in L. Lewin's book on poisons. He differentiates between two variants: one gastric, the other cerebral. The former begins with diarrhoea, vomiting, colic, thirst, and in most cases ends in convalescence. The latter shows the following symptoms: headache, somnolence, pain in the calves, trismus, opistothonus, contractions in the arms, spastic twisting movements of the body, tossing of the head from right to left, muscular jerking of the upper and lower left extremities, dizziness, groaning, moaning, hydrocephalic yelling, mydriasis, and amaurosis (cf. Lewin, 1929, p. 915 f.). This variant usually leads to death. Wasson's description appears to correspond to Lewin's less dangerous variant. Yet, even Lewin's cerebral variant definitely lacks the critical symptom of mental derangement as an initial phase. Moreover, it seems to be impossible to predict which type of poisoning will occur in a person. Lewin relates

the case of a family whose members all ingested *A. phalloides*. Some showed symptoms of the gastric variant, others of the cerebral, although they had eaten from the same dish of mushrooms on the same day. Subsequently some died, whereas others survived.

The temporal sequence of *A. phalloides* poisoning does not correspond to that which the murderers of Claudius seem to have expected. According to Wasson, the incubation period is 6–40 hours or more. E. Leschke mentions 10–12 hours. Greif and Braun figure 7–48 hours; Fazekas and Jakobovits 8–10 hours. Lewin considers 9–24 hours as normal. These figures suggest an incubation period with a minimum of six and a maximum of forty-eight hours before the first symptoms appear. In the case of Claudius, the conspirators expected the first symptoms to appear immediately, i.e. during the dinner, rather than six hours or even two days later. This was their only chance to make sure of the success of their effort to poison Claudius. Once the dinner was over, Claudius might be under control of their enemies again, and enemies they had at the imperial court.

In order fully to understand this we must bear in mind the relationship between Claudius and Agrippina, which had become rather precarious by then. Agrippina deceived her husband by becoming the mistress of his treasurer Pallas. Claudius probably knew of this, for Tacitus reports:

> ". . . he had remarked in his cups that it was his destiny first to endure his wives' misdeeds, and then to punish them." (Tacitus, Ann., XII, 65, trans. by M. Grant)

Narcissus, Claudius' secretary and probably the most powerful man at court, had already succeeded in eliminating Messalina because of her adultery. This man was Agrippina's avowed enemy. He was waiting only for the moment when she made another mistake—for one

she had already made when, in the presence of Claudius, she had accused Narcissus of avarice and embezzlement. But he had dared to defend himself eloquently and, in turn, attacked Agrippina. On the other hand, it seems that Narcissus' position became increasingly weaker. For example, he had tried in vain to save Domitia Lepida, whose trial was directed from behind the scenes by Agrippina. Tacitus reports that Narcissus felt increasingly unsafe and considered his fall inevitable. In this duel between Narcissus and Agrippina he who would make the first mistake would be the loser. Agrippina had the poison ready, and Narcissus is reported to have said to his closest friends:

"convictam Messalinam et Silium: pares iterum accusandi causas esse. **, si Nero imperaret; quamquam ne impudicitiam quidem nunc abesse Pallante adultero, ne quis ambigat decus pudorem corpus, cuncta regno viliora habere." (Tacitus, Ann., XII, 65, 2, H. Fuchs ed.) (4)

"Messalina and Silius had received their condemnation and there was again similar material for a similar charge . . . (Though), even now, infidelity was not far to seek, when she had committed adultery with Pallas, in order to leave no doubt that she held her dignity, her modesty, her body, her all cheaper than a throne!" (Tacitus, Ann. ibid., transl. by J. Jackson, p. 411)

These words show that Narcissus, too, was prepared to strike. In addition, security measures for the Emperor were rigid:

". . . he never attended a banquet unless with an escort of javelin-bearing Guards, and waited upon by soldiers. Before entering a sick-room he always had it carefully gone over: pillows and mattresses were prodded, and bedclothes shaken out. Later, he even required all visitors to be searched when they came to pay him a morning call, and excused no one. Indeed it was not until the end of his reign that he reluctantly gave up the practice of having women, boys, and girls pawed about during these routine examinations, and of removing the stylus-case from every caller's attendant or secretary." (Suetonius, Divus Claudius, transl. by R. Graves, p. 202)

Agrippina was in a very difficult situation. She had

to face her own liquidation if she was not able to kill Claudius in time and put her son Nero on the throne. A banquet probably offered the best chance to accomplish the task of killing the Emperor.

It was Narcissus who made the first mistake as he left Rome and went to Sinuessa, a small town a few miles north of Naples, for a cure. So he had no chance to react immediately. Yet, he could have been back in Rome within a few hours. Considering these circumstances, Agrippina had to see with her own eyes that the poison had really worked before the dinner was over, leaving the Emperor under the control of Narcissus and his faction again.

It does not seem convincing that the murderers should have chosen a poison the effects of which might at best occur after six hours, with the possibility that this period of delay might turn out to be unforeseeably longer—perhaps two days. We doubt, therefore, that the poison used was *A. phalloides*.

Our doubts grow even stronger when we turn to letter 95 of the Epistulae Morales Ad Lucilium by L.A. Seneca. From this letter, R.G. Wasson quotes a passage which, in his view, is to be understood as an allusion to the poison used to murder Claudius:

> "Di boni, quantum hominum unus venter exercet! Quid? Tu illos boletos, voluptarium venenum, nihil occulti operis iudicas facere, etiam si praesentanei non fuerunt?" (cf. Wasson, p. 121)

As we have already pointed out, there is little support for the hypothesis that 'boletus' ever designates a poisonous mushroom, whereas there is some evidence indicating that this word may designate certain tasty—or, at least, edible—mushrooms. Even the apposition "voluptarium venenum" does not justify the conclusion that Seneca was speaking of a poisonous mushroom. The translation given by Wasson is erroneous, as it reads: "a tasty poi-

son", thus missing the point. More correctly, the two words are translated as "this poison of gluttony" (O. Apelt: "dieses Gift der Wollust") or with: "the epicure's poison" as in the Loeb edition of 1953. However, proof of the adequacy of this translation is not obtained from the quoted sentence alone. The whole context in which it appears has to be taken into consideration.

The topic of gluttony and revelry is by no means limited to letter 95. It continues throughout all of the 124 letters. Seneca touches on it in almost every letter, dealing with it in detail in letters 51, 59, 60, 86, 95, 108, 119, 122, and 123. In letter 95, he starts with the question whether man can live a blissful life by just observing moral rules. This leads him to the moral rules of the ancients. Their rules were simple, as were their lives. Having no complicated vices, they also had no complicated diseases. At this point, Seneca comes to speak of the connection between medicine and nutrition:

"Medicina quondam paucarum fuit scientia herbarum, quibus sisteretur fluens sanguis, vulnera coirent; paulatim deinde in hanc pervenit tam multiplicem varietatem. Nec est mirum tunc illam minus negotii habuisse firmis adhuc solidisque corporibus et facili cibo nec per artem voluptatemque corrupto: qui postquam coepit non ad tollendam, sed ad invitandam famem quaeri et inventae sunt mille conditurae, quibus aviditas excitaretur, quae desiderantibus alimenta erant, onera sunt plenis." (Seneca, ep. mor., XV, ep. 95, 15, A. Beltram ed.)

"Medicine once meant acquaintance with a few herbs to staunch bleeding and bring a wound together: since then it has gradually reached its present manifold variety. That it had less to contend with in those days is not surprising: bodies were still hard, sound flesh; food was the handiest; gastronomy had not debauched it. But ever since the search for it as a means not of removing but of exciting hunger began; from the moment when untold processes of seasoning to stimulate appetite were discovered, what was once the sustenance of the hungry has become the burden of the surfeited." (Seneca, ep. mor., ep. 95, transl. by E. P. Barker, p. 144)

The senseless and excessive gluttony of his contempo-

raries was—in Seneca's eyes—the very cause of a vast number of diseases ranging from swollen nerves and vomiting of bile to "pins and needles" in the brain. Seneca's explanation:

"Ill health was simple and sprang from a simple cause: multiplication of the dishes caused multiplication of disorders." (Seneca, ep. mor., ep. 95, transl. by E. P. Barker, p. 144)

To Seneca, excessive gormandizing and gluttony are the roots of the malaise of Roman society, the ultimate cause of the physical and moral decay of his contemporaries. He complains of the school of rhetoricians and philosophers standing empty while young people crowd around the cooking pots of gormandizers. He then goes into the details of the great banquets:

"Transeo puerorum infelicium greges, quos post transacta convivia aliae cubiculi contumeliae exspectant. Transeo agmina exoletorum per nationes coloresque discripta, ut eadem omnibus levitas sit, eadem primae mensurae lanuginis, eadem species capillorum, ne quis, cui rectior est coma, crispulis misceatur. Transeo pistorum turbam, transeo ministratorum, per quos signo dato ad inferendam cenam discurritur. *Di boni, quantum hominum unus venter exercet! Quid? Tu illos boletos, voluptarium venenum, nihil occulti operis iudicas facere, etiam si praesentanei non fuerunt?* Quid? Tu illam aestivam nivem non putas callum iocineribus obducere? Quid? Illa ostrea, inertissimam carnem caeno saginatam, nihil existimas limosae gravitatis inferre? Quid? Illud sociorum garum, pretiosam malorum piscium saniem, non credis urere salsa tabe praecordia? Quid? Illa purulenta et quae tantum non ex ipso igne in os transferuntur, iudicas sine noxa in ipsis visceribus extingui?" (Seneca, ep. mor. XV, ep. 95, 24–25, A. Beltram ed.) (5)

"I won't enlarge on the shoals of unhappy young people for whom waits the further dishonour of the bed when service at the board was over. I won't linger over the companies of epicene favourites, all in each group having the same softness of skin, the same development of adolescent down, the same growth of hair, no straight locks intruding among the curly heads. I won't say much about the horde of confectioners, of serving-men who at a nod scurry all ways at once to bring the dinner in. *Good heavens, what a mess of humanity for one belly to busy! And now, do you really think those mushrooms—sensuous bane—set no veiled energies to work, even if their effects are not immediate?* Again, do you suppose your snow in summertime doesn't indurate the

liver? Those oysters too, lumps of lifeless slime-fattened tissue, do you imagine they don't leave in you some of their muddy inertia? And the renowned 'Federal Relish'—that priceless liquor exuded by an indigestible fish in its putrescence—mustn't its salt humour be like a flame in the bowels, think you? Once more, can you suppose that those decaying morsels whisked all but from fire to lip can find an innocent extinction in your very interior?" (Seneca, ep. mor., ep. 95, transl. by E. P. Barker, p. 147)

"Ich übergehe die Schar der unglücklichen Knaben, deren nach Schluss des Gelages andere Misshandlungen im Schlafgemach harren. Ich übergehe die Reihen der Schandbuben, die nach Nationen und Farben abgeteilt sind: jede Abteilung soll die nämliche Glätte, die gleiche Länge des ersten Flaumes, das gleiche Haupthaar haben; keiner mit strafferem Haar soll unter die Krausköpfe geraten. Ich übergehe den Schwarm der Bäcker und Aufwärter, die auf das gegebene Zeichen hierhin und dorthin rennen, um das Mahl aufzutragen. *Gute Götter! Wieviel Menschen setzt ein einziger Bauch in Bewegung! Wie? Glaubst du, dass jene Pilze, dieses Gift der Wollust, keine geheime Wirkung ausüben, wenn sich dieselbe auch nicht augenblicklich zeigt?* Wie? Meinst du etwa, dass jener Sommerschnee keine Verhärtung der Leber zur Folge habe? Wie? Dass jene Austern, das unverdaulichste Fleisch, mit Kot gemästet, dir keine Schleimbeschwerden bereiten werden? Wie? Jene Lake aus der Provinz, der hochgeschätzte Saft von schädlichen Fischen, glaubst du nicht, dass sie dir durch ihre faulende Flüssigkeit die Eingeweide entzünde? Und glaubst du, dass jene Eitermasse, die fast unmittelbar aus dem Feuer in den Mund gelangt, ohne Schaden in den Eingeweiden selbst ihr Grab findet?" (Ibid. transl. from O. Apelt, p. 154 f.)

Here we find the sentence quoted by Wasson in a context indicating quite clearly that mushrooms are only one of the dishes against which Seneca campaigned. To him, the victuals mentioned in the text are the non plus ultra of unnatural nutrition. The passage in which they appear is remarkably homogenous in style. All sentences have interrogative character and are linked together by the repeated rhetorical "Quid?" It must, therefore, be understood as a coherent unit. Our interpretation is corroborated by the only other passage in his letters, where Seneca mentions 'boleti':

"Inde ostreis boletisque in omnem vitam renuntiatum est: nec enim

cibi, sed oblectamenta sunt ad edendum saturos cogentia, quod gratissimum est edacibus et se ultra quam capiunt farcientibus, facile descensura, facile reditura." (Seneca, ep. mor. XVII–XVIII, ep. 108, A. Beltram, ed.)

"Hence my lifelong renunciation of oysters and mushrooms, for these are not foods but provocatives driving the sated to eat (a most engaging quality to gluttons who cram themselves beyond their capacity), and as easily up again as they are easily down." (Seneca, ep. mor., ep. 108, transl. by E. P. Barker, p. 225)

It is evident: to Seneca this kind of food, especially oysters and mushrooms, represent the height of gluttony. He, too, used to eat them but overcame this vice in time. If he calls them a poison, this is only to express his feelings of distrust and disgust for what to him is gluttony par excellence. Seneca's attitude towards mushrooms appears to bear marked traits of mycophobia.

We conclude, therefore, that the sources available to us do not support Wasson's hypothesis that Claudius was poisoned with *A. phalloides*.

Let us now turn to Wasson's second hypothesis. Could the second poison—if there were one—have been *Citrullus colocynthis* (L.) Schrader? Wasson did not develop this second thesis so elaborately as the first one, which makes it somewhat difficult to formulate his arguments precisely. The following circumstances seem to speak in favor of his thesis: Claudius' last words are said to have been "Vae me! puto concacavi me." "Woe is me! I think I have fouled myself." These words support the assumption that Claudius was suffering from severe diarrhoea shortly before he died. *C. colocynthis*, being a drasticum, may well be thought of as the cause of such severe diarrhoea. Furthermore, Wasson believes that an allusion to the poison which finally killed Claudius must be seen in the title of Seneca's satire "Apocolocyntosis". He interprets the -colocynt- between the prefix Apo- and the suffix -osis as a reference to *C. colocynthis*.

In the following, we shall examine these two points.

Only Tacitus and Suetonius report a second poisoning. In Suetonius' text, we find a hint of the possibility that the poison was administered as an enema:

"Etiam de subsequentibus diversa fama est. Multi statim hausto veneno obmutuisse aiunt excruciatumque doloribus nocte tota defecisse prope lucem. Nonnulli inter initia consopitum deinde cibo affluente evomuisse omnia, repetitumque toxico, incertum pultine addito, cum velut exhaustum refici cibo oporteret, an immisso per clystera, ut quasi abundantia laboranti etiam hoc genere egestionis subveniretur." (Suetonius, Divus Claudius, XLIV, H. Ailloud ed., vol. 2, p. 148)

"Reports also differ as to what followed. Many say that as soon as he swallowed the poison he became speechless, and after suffering excruciating pain all night, died just before dawn. Some say that he first fell into a stupor, then vomited up the whole contents of his overloaded stomach, and was given a second dose, perhaps in a gruel, under pretense that he must be refreshed with food after his exhaustion, or administered in an enema, as if he were suffering from a surfeit and required relief by that form of evacuation as well." (Suetonius, J. Gavorse ed., p. 236)

This passage tells us that Suetonius himself does not believe that he is relating established facts. He remains skeptically detached from his own report by explicitly stating that he is just reporting rumors and opinions. One rumor says nothing of a second poisoning: Claudius died from the first poison. The second rumor gives two variants: he was indeed administered a second poison—according to the first variant, orally in a porridge; according to the second, rectally as an enema. Whatever they say, we must discard Suetonius' rumors as representing only hearsay information to which we should not give more credit than Suetonius does himself.

In comparison, Tacitus' report sounds more reliable. The text (Ann., XII, 67) has already been quoted. Tacitus stresses that the events which happened during the memorable banquet became known in every detail later on. He refers to writers living at the time of the

murder. Tacitus, in contrast to Suetonius, is evidently convinced of the correctness of his report. In his own judgment, he does not report rumors but facts. In addition, the sequence of events, as Tacitus describes them, appears motivated and plausible. His description reads as if told by an eyewitness. Its most dramatic scene would not make any sense, unless the second poisoning were performed in the same room which served as the dining room. This is the very moment when Agrippina —in her fear that the plot might fail—intervenes personally, at the risk of arousing the suspicion of those present. And this she certainly did, for we may safely assume that there was no one in the room who did not know that Agrippina had a motive to murder her husband: she wanted to make her son Nero successor to the throne and at the same time save her own life. This situation also provides a possible explanation as to why these events—as Tacitus says—became so well known later on: it all happened in front of eyewitnesses. It seems, then, that we must consider the report given by Tacitus as more reliable than the one given by Suetonius, which means that we have to start from the fact that the second poisoning was performed in the same room which served as the dining room rather than outside of this room—e.g. in the bedroom—and that the poison was administered orally on this occasion rather than rectally, the clyster story being comparatively improbable.

We may discard as completely improbable the assertion that Xenophon possibly was in a position to extract the active principle from *C. colocynthis*, the so-called colocynthine which, according to F. A. Flückiger, was isolated for the first time by Lebourdais in 1948. This substance seems to be a glycoside. With reduced hydrochloric acid, it can be split into sugar and the so-called colocyntheïne. The lethal dose of colocynthine is, ac-

cording to Lewin, 4 grams. Ludewig and Lohs name elaterine as the active principle in *C. colocynthis*, the lethal dose being 3 grams. J. A. Kunkel does not consider the glycoside colocynthine to be the proper poison, but the colocyntheïne which is generated after reaction with hydrochloric acid in the human stomach. He gives a lethal dose of 4 grams. Application of the chemically pure poison can be excluded from further consideration. Like Dioscurides and Scribonius Largus in their prescriptions, Xenophon must have utilized the fruit pulp if he wanted to prepare an applicable poison from *C. colocynthis*. The fruit pulp contains colocynthine in a concentration of 0.6%. Fruits of *C. colocynthis* are on an average the size of an apple or an orange. From the botanical division of the pharmaceutical company Dr. Madaus & Co., Cologne, we learned that the average colocynth fruit weighs about 180–200 grams and measures about 7.5 cm. in diameter. Our estimate of the proportions in weight (fruit pulp : skin + core = 2 : 1) was confirmed by several pharmacologists as realistic. One fruit of a total weight of 200 grams thus contains approximately 133.32 grams of fruit pulp, and 0.8 grams of chemically pure colocynthine. If Xenophon intended to kill Claudius with *C. colocynthis*, he would have had to administer to him at least 4 grams of pure colocynthine. Had he wanted to be on the safe side, he would have had to administer a considerably larger amount, for Lewin reports that even 15 grams—3.5 times the lethal dose!—have at times not proved fatal. Four grams of colocynthine are contained in 666.60 grams of fruit pulp; in order to gain 15 grams, Xenophon would have had to process 2.3 kilograms of fruit pulp. Obviously he could not have smeared such a large quantity on a feather. He may have prepared a decoction or maceration, but even then he would have found it difficult to reduce this enor-

mous mass of fruit pulp to a quantity which could be smeared on a feather (6). Even if he had succeeded in reducing the fruit pulp to a paste or powder, there would still have remained a considerable amount of solid matter—certainly too much to besmear a feather with it.

More than these technical obstacles, another fact argues against the possibility that colocynth could have been administered orally: its extraordinary bitterness. Although, for example in the prescriptions of Scribonius Largus, only comparatively small quantities of the fruit pulp of colocynth are used, the extreme bitterness of the ingredient is pointed out (cf. prescription 99). Aromatics are added to mask the bitter taste of colocynth. For comparison: if we rate the denary weight at the time of Scribonius Largus at 3.4 grams (7), prescription 99 contains about 7 grams of colocynth substance, prescription 106 about 35 grams. Xenophon would have had to administer 20 times or even 66 times as much. It seems most unlikely that Xenophon was able to administer such an overdose of gall-bitter stuff orally without provoking noticeable disgust or even actual vomiting in Claudius, which in turn would have aroused more suspicion, rendering the situation even more precarious and increasing the risk of failure.

Also arguing against *C. colocynthis* is the fact that, according to Tacitus, Xenophon used a rapidly acting poison ("rapido veneno"). By this, we commonly understand a poison which kills within minutes. So far as we can see from the literature, colocynth is not such a poison. It does not kill within minutes, nor even within hours. In fact, we could not find a single case in the sources proving beyond doubt that a person had ever died from colocynth poisoning. Even in cases of severe poisoning, symptoms drag on over a period of several days. Leschke reports the case of a young woman who tried to commit

suicide with a decoction of colocynth. She is said to have drunk a large liqueur glass of the decoction and to have fallen unconscious "soon after". Symptoms persisted for five days. On the sixth day, she had recovered. Lewin reports another case: the symptoms of the poisoning lasted for two days. If we assume that colocynth is a deadly poison at all, we must conclude that, even if a colocynth poisoning leads to death, a considerable amount of time elapses between the ingestion of the poison and exitus: one or two days—as we see it.

This and the circumstance that even 15 grams of chemically pure colocynthine do not necessarily cause death must disqualify *C. colocynthis* as a suitable poison for Agrippina and Xenophon's purpose in the given situation. They needed a tasteless poison which, even if administered in minimal quantities, would kill safely and within minutes. *C. colocynthis* does not seem to fulfill these requirements.

We now come to the last point of our discussion: does the title "Apocolocyntosis" refer to *C. colocynthis*—as an in-group joke so to speak? There are two ways to answer this question: by etymology and by text analysis.

Between the prefix Απο- and the suffix -ωσις the crippled noun -κολοκυντ- has been inserted by whoever coined this artificial word. We call -κολοκυντ- a crippled noun, because it lacks an ending. H. Stephanus gives as the Greek equivalents to the Latin 'cucurbita'—i.e., the generic name for all cucurbitaceous plants (in German: Kürbis) -the following forms: κολοκύνθη, κολοκύντη, κολόκυνθος, κολόκυντος, κολόκυνθα, and κολόκυντα. He explains:

"Hellespontii κολοκύντας nominare solent τὰς περιψερεῖς, Rotundas cucurbitas: σικύας vero, τὰς μακρὰς, Oblongas: quas aliqui et Ἰνδικας κολοκύντας appellant: haeque ut plurimum ἔψονται, illae etiam ὀπτῶνται."

W. Pape lists the words κολοκύνθη with the attic ver-

sion *κολοκύντη*, *κολόκυνθα*, and *κολόκυντα* as equivalents to "cucurbita, der runde Kürbis". Liddell and Scott list the words *κολοκύνθη* with the attic version *κολοκύντη*, *κολόκυνθα* and *κολόκυντα* as equivalents to "round gourd, Cucurbita maxima".

As equivalents to cucurbita silvestris, however, which is the name used by Scribonius Largus and Dioscurides to denote *C. colocynthis*, Stephanus gives the Greek words, *κολοκυνθίς* and *κολόκυντα*, the latter with reference to Dioscurides. Pape, with reference to Galenus, lists *κολοκυνθίς* as equivalent to "die Koloquintenpflanze und ihre Frucht". Liddell and Scott provide the most precise information, giving *κολόκυνθα ἀγρία* as standing for "colocynth, Citrullus colocynthis" at the same time referring to Dioscurides, IV, 176. It is this passage in Dioscurides which proves that *κολόκυνθα ἀγρία* and *κολοκυνθίς* are synonymous with cucurbita silvestris.

We thus have the stem -*κολοκυν*- to which, depending upon time, dialect, and writer various endings are attached. Combined with the endings -*θα*, -*τα*, -*θη*, -*τη*, -*θος*, and -*τος* it forms a variety of words, all of which are generic names for the genus of Cucurbitaceae, equivalent to the Latin 'cucurbita' and the German 'Kürbis', whereas for *C. colocynthis* there are two names, one being a combination of the stem -*κολοκυν*- with the ending -*θίς*, the other consisting of a variant of the generic name *κολόκυνθα* and the qualifying adjective *ἀγρία* = wild.

We must content ourselves with the realization that, from the crippled -*κολοκυντ*- in *Ἀπο-κολοκύντ-ωσις*, we cannot conclude that it refers to *C. colocynthis*, as we do not know the ending. The occurrence of a -*τ*- instead of a -*θ*- in the word would rather suggest that it is meant to refer to the generic name of Cucurbitaceae.

In our view, even the analysis of the text of the *Ἀποκολοκύντωσις* does not support the assumption that

its title alludes to *C. colocynthis*. Like Wasson, we hold that the translation "Pumpkinification", respectively "Verkürbissung" is wrong. It is wrong because it superficially focuses attention on the botanical meaning of the word. If, however, *'Αποκολοκύντωσις* alludes to the Greek generic name for Cucurbitaceae, every educated Roman of the time knew that the Greek word stood for the Latin 'cucurbita', which was a commonly used metaphor for 'fool' or 'madman'. This view is supported by C. F. Russo:

"E se poniamo mente al fatto che anche presso gli antichi *κολοκύνται* e cucurbitae venivano dette le teste piutosto dure ed insulse, . . ." (Russo, p. 17)

Russo, in his footnote no. 28, gives proof of this, referring to the use made of the word by Greek and Latin writers. He says "*anche* presso gli antichi", for in Italian the expression "zuccone", from "zucca"—'Kürbis'—'cucurbita', is still in use today, signifying 'fool'. (8)

The title *'Αποκολοκύντωσις* appears only in the work of Dio Cassius Cocceianus. The text reads:

"*συνέθεκε μεν γαρ και ὁ Σενέκας σύγγραμμα ἀποκολοκύντωσιν αὐτὸ ὥσπερ τινὰ ἀθανάτισιν ὀνομάσας.*" (Dio Cassius, LXI, 35, 3)

"For Seneca published a paper which he called Apocolocyntosis as if to allude with it to a person's immortality." (Transl. Deltgen/Kauer)

Russo, basing his argument mainly on this passage, does not interpret the title as "trasformazione in una zucca", but rather as "deificazione di una zucca, di uno zuccone" or "zucconeria divinizzata", which is 'idiotism deified' or 'madness deified'. He tries to find an equivalent to Apocolocyntosis in Italian:

"Nel termine *ἀποκολοκύντωσις* c'è lo stesso scherzo che ricorre per Claudio in 7, 3 e 8, 3, ove al formulare *θεός* è sostituito *μωρός*, idiota (. . .). Non disse dunque *ἀποθέωσις* (né poteva dirlo bene, perché nella satira non v'è un'apoteosi) ma *ἀπο . . . μώρωσις* o meglio *ἀπο . . .*

κολοκύντωσις, cioé non indiamento, ma in . . . diotimento: come se, per riprendere le parole di Dione Cassio, *ἀποκολοκύντωσις* potesse essere un sinonimo di *ἀπαθανάτισις* (il termine *ἀποθέοσις* è ignoto a Dione Cassio).'' (Russo, p. 132.) (9)

The artificial word ''indiotimento'', in our view, fairly accurately translates Apocolocyntosis into Italian with regard to both its form and its content. Russo's interpretation of the title not only has the advantage of being philologically coherent, it is also corroborated by the analysis of the text. In the following, we have listed those passages from the Apocolocyntosis, where Claudius is either explicitly designated as a fool or madman, or where reference is made to his physical disabilities as an expression of his madness.

Passages from the Apocolocyntosis alluding to Claudius' mental deficiencies:

''ego scio me liberum factum, ex quo suum diem obiit ille, qui verum proverbium fecerat aut regem aut fatuum nasci oportere.'' (I, 1)

''I know I have been free to do as I like since the day when he died who made the proverb true: One must be born either king or fool.'' (A. P. Ball ed., p. 132, 1)

''nemo enim unquam illum natum putavit.'' (III, 2)

''. . . for nobody ever made any account of his being born.'' (A.P. Ball ed., p. 134, 3) (10)

''haec ait et turpi convolvens stamina fuso abrupit stolidae regalia tempora vitae.'' (IV, 1)

''Thus having spoken she wound up the thread on his spindle neglected, breaking off the royal days of his stupid existence.'' A. P. Ball ed., p. 135, 4)

''haec satis animose et fortiter, nihilo minus mentis suae non est et timet *μωροῦ πληγήν*.'' (VII, 3)

''These things he said with spirit, and boldly enough. All the same, he was inwardly a good deal afraid of the madman's blow. (A.P. Ball ed., p. 141, 7)

''deus fieri vult: parum est quod templum in Britannia habet, quod hunc barbari colunt et ut deum orant *μωροῦ εὐλάτου τυχεῖν*?'' (VIII, 3)

"He wants to become a god. Isn't he satisfied that he has a temple in Britain; that the barbarians worship him and beseech him as a god that they may find him a merciful madman?" (A. P. Ball ed., p. 142f., 8)

Allusions to his physical disabilities:

"tamen si necesse fuerit auctorem producere, quaerito ab eo qui Drusillam euntem in caelum vidit: idem Claudium vidisse se dicet iter facientem 'non passibus aequis'." (I, 2)

"Still, if I must produce my authority, apply to the man who saw Drusilla going heavenward; he will say he saw Claudius limping along in the same direction." (A. P. Ball ed., p. 132, 1)

"nuntiatur Iovi venisse quendam bonae staturae, bene canum; nescio quid illum minari, assidue enim caput movere; pedem dextrum trahere. quaesisse se cuius nationis esset; respondisse nescio quid perturbato sono et voce confusa; non intellegere se linguam eius, nec Graecum esse nec Romanum nec ullius gentis notae." (V, 2)

"The news was brought to Jupiter that somebody had come, a rather tall man, quite gray-headed; that he was threatening something or other, for he kept shaking his head; and that he limped with his right foot. The messenger said he had asked of what nation he was, but his answer was mumbled in some kind of an incoherent noise; he didn't recognize the man's language, but he wasn't either Greek or Roman or of any known race." (A. P. Ball ed., p. 138, 5)

"tum Hercules primo aspectu sane perturbatus est, ut qui etiam non omnia monstra timuerit. ut vidit novi generis faciem, insolitum incessum, vocem nullius terrestris animalis sed qualis esse marinis beluis solet, raucam et implicatam, putavit sibi tertium decimum laborem venisse. diligentius intuenti visus est quasi homo." (V, 3)

"Herkules at the first sight was a good deal disturbed, even though he was one who didn't fear any sort of monsters. When he beheld the aspect of this unknown specimen, its extraordinary gait, its voice belonging to no earthly creature but more like that of the monsters of the deep, hoarse and articulate, he thought that a thirteenth labor had come to him. When he looked more carefully, however, it appeared to be a man." (A. P. Ball ed., p. 138f., 5)

"quid nunc profatu vocis incerto sonas? quae patria, quae gens mobile eduxit caput?" (VII, 2)

"What's that, that in a muffled voice you're trying to say? Where is the land or race to own your shaky head?" (A. P. Ball ed., p. 140, 7)

As these passages indicate, Claudius is, in fact, depicted as a fool, showing both mental and physical symptoms of idiotism. Naturally, such a monster cannot be a Roman:

"Luguduni natum est, Planci municipem vides. quod tibi narro, ad sextum decimum lapidem natus est a Vienna, Gallus germanus. itaque quod Gallum facere oportebat, Romam cepit." (VI, 1)

". . . he was born at Lugudunum; you behold one of Marcus' citizens. As I'm telling you, he was born sixteen miles from Vienna, a genuine Gaul. And so as a Gaul ought to do, he captured Rome." (A.P. Ball ed., p. 139, 6)

Now all the crimes of monstrous Claudius are listed: he is held responsible for the murder of 35 senators, 221 nobles and "ceteros *ὅσα ψάμαθός τε κόνις τε.*" (XIV, 1) Seneca writes:

". . . tam facile homines occidebat, quam canis adsidit." (X, 3)

"This fellow, . . . , used to kill people as easily as a dog stops to rest." (A.P. Ball ed., p. 145, 10)

He disregarded the law:

"deflete virum, quo non alius potuit citius discere causas, una tantum parte audita, saepe et neutra." (XII, 3)

"Mourn for the man than whom no one more quickly
Was able to see the right in a lawsuit,
Only at hearing one side of the quarrel,—
Often not either." (A.P. Ball ed., p. 149, 12)

Finally, he wasted Roman citizenship on everybody:

"sed Clotho 'ego mehercules' inquit 'pusillum temporis adicere illi volebam, dum hos pauculos, qui supersunt, civitate donaret'—constituerat enim omnes Graecos, Gallos, Hispanos, Britannos togatos videre—'sed quoniam placet aliquos peregrinos in semen relinqui et tu ita iubes fieri, fiat'." (III, 3)

"But Clotho remarked, 'I swear I intended to give him a trifle more time, till he should make citizens out of the few that are left outside—for he had made up his mind to see everybody, Greeks, Gauls, Spaniards, Britons, wearing togas. However, since it is perhaps a good thing to have a few foreigners left as a nucleus, and since you wish it, it shall be attended to'." (A. P. Ball ed., p. 134f., 3)

To the picture of a complete idiot are to be added the qualities of a bloodthirsty tyrant, who murders nobles and common people, violating the law and wasting Roman citizenship on the inhabitants of the provinces. Claudius, who appears to us hardly more despicable than Agrippina, is depicted as a terrible monster, a tyrant par excellence. In this way, Seneca succeeds in transforming a murder committed for egoistic reasons into tyrannicide and thus declares it the good deed of the year. Contrasted against that gloomy background. Nero appears to better advantage. Paragraph IV, 1 2 is a shameless praise of the new emperor. He is covered with laurel beforehand and depicted as a good monarch, upholding justice. Even the gods praise him, the Fatal Sister spins an extra long thread of life for him, and the philosopher Seneca does not hesitate to praise him as a great singer. We may assume that Seneca would have risked his life, had he dared to give a true report of the circumstances. We assume, as Wasson does, that Seneca was informed about the murder of the emperor. His Apocolocyntosis was obviously intended to give him a chance to survive. Claudius is depicted as the incarnation of evil. Consequently, the murder appears to be morally justified. In this way, he subsequently provides the murderers with an altruistic motive, thus easing their conscience. Is it uncomfortable to have witnesses to a good deed? By praising the new ruler enthusiastically as the rescuer of the state and of law and order, he recommends himself as a royal propagandist, and exerts a certain moral pressure upon the young Nero. He must not disappoint the great expectations and hopes connected with his person. In this light, the Apocolocyntosis is to be considered as a psychologically clever move in order to survive in the given situation. To assume that Seneca intended to allude to the poison which killed Claudius does not fit the

obviously opportunistic intention of the text as a whole. Seneca's endeavors to avoid any personal danger would have been doomed to failure by such an allusion. (11)

There is some evidence that -colocynt- in Apocolocyntosis was not only meant to signify 'fool', but something else. M. Deltgen mentions that the term 'cucurbita' occurs towards the end of the twelfth century in the feudal law of the Langobards, where we find the expressions 'cucurbitare' and 'cucurbitatio':

"si fidelis cucurbitaverit dominum, i.e. cum uxore ejus concubuerit . . . " (liber feudorum, I, tit. 5, 1, in Deltgen, p. 33)

'Cucurbitare' is a synonym of 'to commit adultery'. Ducange explains:

"uxorem alterius adulterio polluere, proprie de vasallo, qui domini uxorem adulterio polluit et ejus ventrem instar cucurbitae inflat, i.e. impregnat." (In Deltgen, p. 33)

"To dishonor a married woman by adultery. In particular, it refers to a vassal who has seduced the wife of his feudal lord and who in this way makes her abdomen swell like a pumpkin, i.e. he makes her pregnant." (Transl. Deltgen/Kauer)

Accordingly, 'cucurbitatio' indicates 'adultery', and 'cucurbita' the deceived husband who comes out of the affair as a loser, a fool.

Therefore, 'cucurbita' signifies not only 'fool', 'idiot' in general, but also a special kind of fool. Since the Langobards in many respects continued Roman tradition, we might suppose that already in Roman times this word stood for cuckold, although we cannot prove it. There are, however, some hints that -colocynt-, contained in the title of Seneca's satire, might be understood additionally in this sense, i.e. that it is possibly an allusion to the Emperor's miserable married life.

When he was still a little boy, he suffered both neglect and persecution by the women surrounding him. His grandmother Augusta, his mother Antonia, and his

sister Livilla despised him and took advantage of every chance to humiliate him. This chain of misfortune with women continued throughout his life: his first fiancée, Aemilia Lepida, was repudiated by him before marriage. The second, Livia Medullina, died of an illness on the very day of the marriage. He was divorced from his first wife, Plautia Urgulanilla, because of her immoral way of life, and because she was suspected of being involved in murder. He was divorced from his second wife, Aelia Paetina, because of constant quarrels. Messalina, his third wife, deceived him—among others—with Silius and was executed. Agrippina finally cuckolded him a second time with Pallas.

These facts remained by no means secret but were generally known. Claudius himself, on several occasions, commented on his miserable married life. With regard to Messalina, Suetonius reports:

"Quam cum comperisset super cetera flagitia atque dedecora C. Silio etiam nupsisse dote inter auspices consignata, supplicio adfecit confirmavitque pro contione apud praetorianos, quatenus sibi matrimonia male cederent, permansurum se in caelibatu, ac nisi permansisset, non recusaturum confodi manibus ipsorum." (Suetonius, Divus Claudius, XXVI, in C. L. Roth)

"But when he learned that besides other shameful and wicked deeds she had actually married Gaius Silius, and that a formal contract had been signed in the presence of witnesses, he put her to death and declared before the assembled praetorian guard that inasmuch as his marriages did not turn out well, he would remain a widower, and if he did not keep his word, he would not refuse death at their hands." (Suetonius, J. Gavorse ed., p. 227)

and with regard to Agrippina:

"Sub exitu vitae signa quaedam, nec obscura, paenitentis de matrimonio Agrippinae deque Neronis adoptione dederat. Siquidem, commemorantibus libertis ac laudantibus cognitionem, qua pridie quandam adulterii ream condemnarat, sibi quoque in fatis esse iactavit omnia impudica, sed non impunita matrimonia." (Suetonius, Divis Claudius, XLIII, in C. L. Roth)

"Towards the end of his life he had shown some plain signs of repentance for his marriage with Agrippina and his adoption of Nero. For, when his freedmen expressed their approval of a trial in which he had the day before condemned a woman for adultery, he declared that it had been his destiny also to have wives who were all unchaste, but not unchastened." (Suetonius, J. Gavorse ed., p. 236)

As these two passages reveal, the emperor considered himself a deceived husband and talked about his wives' adulteries to the praetorians and his freedmen. Behind his back, however, the Emperor's cuckoldship may have been the object of general mockery, and it is therefore not astonishing that in the text of the Apocolocyntosis we find an allusion to this circumstance:

"quid in cubiculo suo faciant, nescit, et iam 'caeli scrutatur plagas'?" (VIII, 3)

"He doesn't know what goes on in his own chamber, and now 'he searches the regions of heaven'." (A. P. Ball ed., p. 142, 8)

Therefore, we hold that the -colocynt- in Apocolocyntosis signifies 'cucurbita' not, however, in the sense of a botanical species, but in the figurative sense of 'fool' or 'madman' and possibly in a limited figurative sense of 'cuckold'.

One may ask now what explanation we have to give for the diarrhoea from which the dying emperor is said to have suffered. The only evidence for this diarrhoea is the already quoted sentence from the Apocolocyntosis (IV, 3): "Vae me, puto concacavi me". It would be reckless to rank this polemic satire among the texts of serious historians. The author of this text was not interested in making true statements, but rather in mocking the Emperor Claudius as effectively as possible. Anyone doubting this should have a look at the next sentence. It reads as follows:

"quod an fecerit, nescio: omnia certe concacavit." (Ibid.)

"I do not know whether he really did this: he certainly fouled everything." (Transl. by Deltgen/Kauer)

It did not matter to Seneca whether it really happened or not. He simply did not want to omit this cynical play upon words. The assumption that the story of the diarrhoea is not a mere invention does not lead us any further, since numerous poisonings are accompanied by severe diarrhoea. In addition, the "evacuation of the bowels" mentioned by Tacitus makes it likely that Claudius was probably already suffering from diarrhoea before he was poisoned.

We do not pretend to have completely refuted Mr. Wasson's hypotheses. Our only concern has been to articulate the evidence against his conclusions. This negative argumentation must suffice, since in our view the historical sources do not at present provide convincing evidence with regard to the plants or rather the poisons by means of which Claudius was murdered. The problem must, therefore, be considered as still unsolved.

Acknowledgments

We wish to express our gratitude to Miss Nikolai from the Gardening Division of Dr. Madaus & Co., Cologne, for useful information about *C. colocynthis*. We also wish to thank Mr. Barley from the department Asia/English of the Deutsche Welle (Voice of Germany), Cologne, who kindly revised the English translation of this article. Last but not least we are greatly indebted to Mr. Elmer W. Smith of Cambridge, Massachusetts, for his advice and constructive criticism.

Notes

1. For some passages we prefer to give our own translations. Here "opimus" is definitely 'fattening', 'rich'.

2. The word "boleto" in the text of H. Fuchs shows these brackets signifying: [ ] = traces in the codex; < > = lacking in the codex. This means that exactly in this critical passage we have to rely upon a conjecture.

3. The "evacuation of the bowels" may have also been due to the Emperor's wretched health. He frequently suffered from intestinal disease and from violent stomach-aches. (cf. Suetonius)

4. The sign ** in H. Fuch's edition indicates a lacuna which could not be filled with certainty.

5. Not italicized in the Beltram edition. We have italicized this sentence quoted by R.G. Wasson as we wish to lay stress upon the fact that it is to be seen in its context.

6. The fruit pulp of *C. colocynthis* is very dry. Had Xenophon prepared a liquid from it he would at best have been able to put a few drops of it on the feather. Had he prepared a powder he would have found it difficult to put a considerable amount of it on the feather.

7. Cf. Lexikon der Alten Welt, under "Denar", column 720.

8. Cf. Schöne, p. 45f.

9. Russo writes "*ἀπαθανάτισις*" whereas in the Boissevain edition of Dio Cassius we found "*ἀθανάτισις*". However, the words are practically synonymous.

10. "Claudius's mother often called him 'a monster: a man whom Mother Nature had begun to work upon but then flung aside'; and, if she ever accused anyone of stupidity, would exclaim: 'He is a bigger fool even than my own son Claudius!'" (Suetonius, Claudius, transl. by R. Graves, p. 183)

11. The letter which Nero sent to the Senate after his mother Agrippina had been killed on his order and in which he justified this bloody murder, had been composed by Seneca. This is another example of Seneca's opportunistic attitude towards Nero. (cf. Tacitus, Ann., XIV, 10, transl. by M. Grant, p. 318)

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BOTANICAL MUSEUM LEAFLETS
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FOUR NEW BRUNFELSIAS FROM NORTHWESTERN SOUTH AMERICA

BY

TIMOTHY PLOWMAN*

The genus *Brunfelsia* comprises from thirty-five to forty species of tropical American shrubs. Several are widely planted as ornamentals in tropical gardens and in conservatories. Other species are employed as medicines and hallucinogens in South America, especially in the Amazon Basin and in Brazil. Notwithstanding the extensive interest which pharmacologists and horticulturists have shown in *Brunfelsia*, the taxonomy of the genus has hitherto not been studied in depth. In the course of preparing a revision of this group, I have found three new species and a new subspecies from northwestern South America. Descriptions are given in the following text. As an aid in differentiating these species from others in the same region, I have appended a key to all of the species known from western South America.

Brunfelsia chocoensis *Plowman sp. nov.*

Frutex 2 m. alta. Rami pauci, nudi, aliquantum nodosi, striati longitudinaliter cortice solubili. Ramuli hornotini glabri, epidermide longitudinaliter soluta. Folia pauca, plerumque apicibus ramulorum approximata, breve petiolata, petiolo crasso, elliptica vel ob-

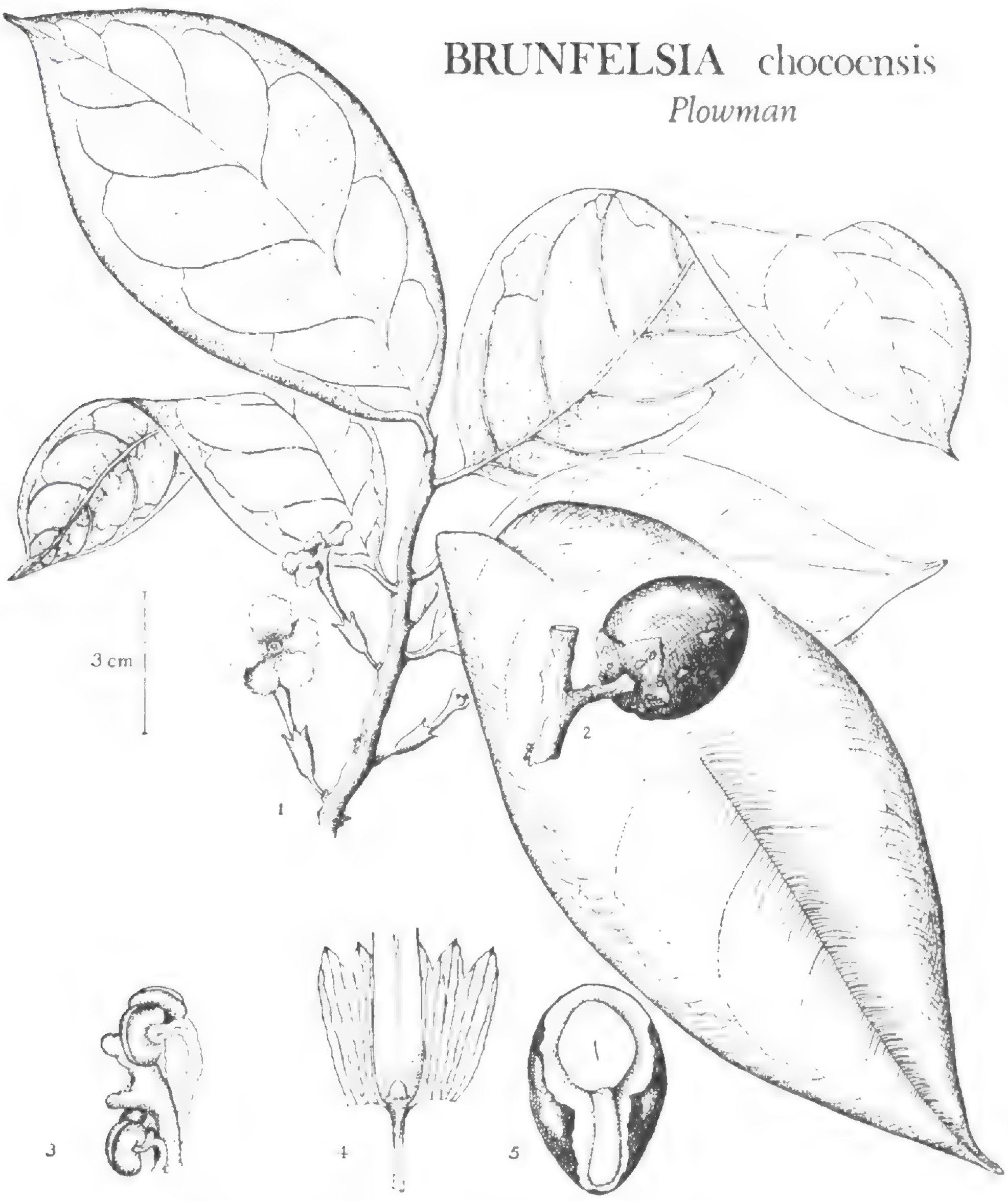
* Botanical Museum, Harvard University.

longa, abrupte vel longe acuminata, acumine saepe subfalcato, basin obtusa, glabra, firme chartacea vel subcoriacea, subtus costa prominenti, rufescenti, nervis lateralibus 6–7, subtus validis, patentibus, late arcuatim anastomosantibus. Inflorescentia terminalis uniflora vel axillaris annotinis ramulis 1–3-flora. Flores fragrantes, albi. Pedunculus brevissimus subbracteatus, bracteis ovatis vel ovato-lanceolatis, caducis. Pedicellus erectus, gracilis, glaber. Calyx tubuloso-campanulatus, prominenter reticulato-venosus, omnino glaber, dentibus ovatis, obtusis vel acutis, ad apicem glanduloso-ciliolatis; calyx in fructu lenticellis obtectus. Corollae tubus quam calyx duplo longior, apicem versus paulatim dilatatus, glaber, limbo ex orificio rotundato patenti, lobis subaequalibus, late rotundatis, margine supra basin parum imbricatis, basi angustatis. Stamina inclusa in tubi tertia parte superiori, filamentis subligulatis, antheris reniformibus vel hippocrepiformibus. Capsula globosa vel ovoidea, carnosa, mesocarpio crasso. Semina 2–5, ovoideo-ellipsoidea, angulata, reticulato-foveata.

A *Brunfelsia macrocarpa* tubo corollae dimidio longiori, calyce non accrescenti et fructu minori (2–3 cm. longo), et a *B. guianensis* foliis majoribus, pedicellis longioribus et lobis corollae latioribus differt.

Type: *O. Haught 4563*, Colombia, Departamento de Antióquia, Chigorodó, forest just southeast of Chigorodó, 45 km. south of Turbo, alt. 50 m. 15 Apr. 1945. Shrub 2 m. high. Flowers rather conspicuous, of a peculiar flat-white color, like unglazed paper (holotype, UC M 048365; isotypes, NY, COL 109727).

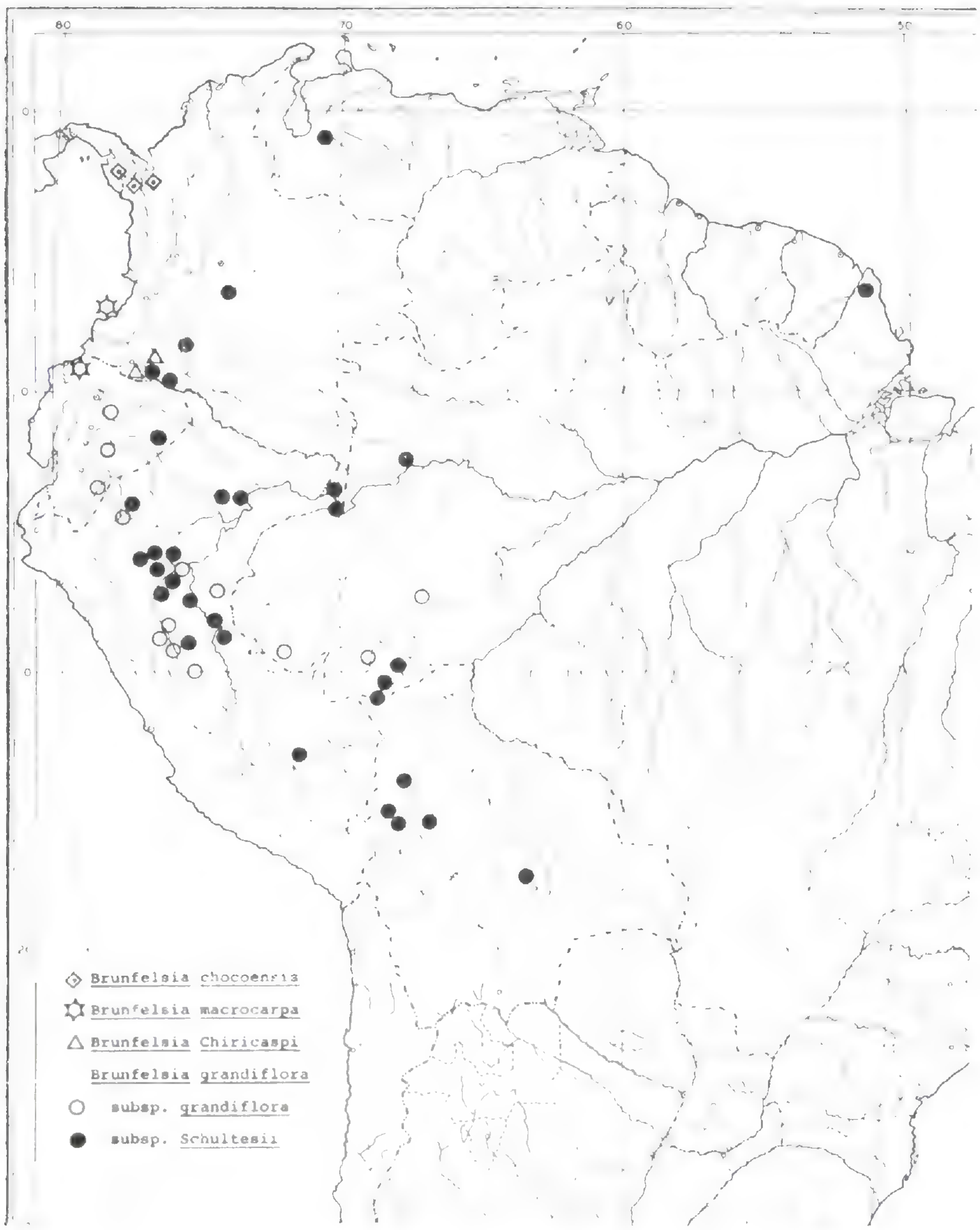
Shrub 2 m. tall. Branches sparse, terete, somewhat knobby at nodes, naked, grey or greyish brown. Branchlets of current year's growth subterete, 3 mm. in diameter, glabrous, shiny, light greyish brown, with epidermis cracking in longitudinal strips; internodes 1–2 cm. long. Leaves few, usually crowded at ends of branchlets, short-



Brunfelsia chocoensis Plowman. 1, flowering branch, approximately one-half natural size. 2, fruit, one-half natural size. 3, upper portion of corolla tube showing stamens and stigma, four times natural size. 4, lower portion of corolla tube showing ovary and excised calyx, twice natural size. 5, seed excised to show embryo, twice natural size.

petiolate, elliptic to oblong, abruptly to long acuminate at apex, the acumen often subfalcate, obtuse at base, 18–28 cm. long, 9–11 cm. wide, glabrous, firmly chartaceous, dull, dark green above, pale green beneath, midrib prominent beneath, light brown, lateral nerves 6–7, spreading, arcuately anastomosing 1 cm. within margin, veinlets finely reticulate; petiole stout, subterete, canaliculate above, 10–15 mm. long, brown. Inflorescence terminal, one-flowered, or, on previous branches, axillary with 1–3 flowers. Flowers fragrant, white. Peduncle very short, subbracteate. Bracts ovate- to ovate-lanceolate, concave, ciliolate at margin, 2–4 mm. long, caducous. Pedicel erect, slender, terete, 5–6 mm. long, glabrous. Calyx tubular-campanulate, globose in bud, 8–12 mm. long, 3–6 mm. in diameter, glabrous throughout, firmly chartaceous, veinlets prominulous, reticulate, teeth erect, ovate, blunt to acute, glandular-ciliolate, 2–4 mm. long, persistent; calyx in fruit to 13 mm. long, dotted with lenticels. Corolla tube cylindric, twice as long as calyx, 22–27 mm. long, 2–2.5 mm. in diameter, gradually dilated toward apex, glabrous; limb 22–25 mm. in diameter, spreading from rounded mouth, 5 mm. in diameter, the lobes subequal, conduplicate in bud, rounded at apex, rarely emarginate, slightly overlapping at margin above base, narrowed at base, 8–10 mm. long. Stamens inserted in upper third of tube; filaments subligulate, 5 mm. long, 1 mm. wide, lower pair curved at apex, upper pair suberect, glabrous; anthers reniform-hippocrepiform, 2 mm. long, light brown. Ovary ovoid, gibbous at base, 2.5 mm. long, glabrous; style slender, curved at apex, 19–20 mm. long; stigma bifid, gaping as a forceps, lobes oblong, 1.5 mm. long. Capsule globose to ovoid, 2–3 cm. long, 2–3 cm. in diameter, smooth, yellow when ripe, indehiscent, mesocarp fleshy, to 1.5 mm. thick, endocarp thin, cartilaginous, enclosing 2–5 seeds.

Plate XV



DISTRIBUTION MAP

Taken from Goode's Series of Base Maps, No. 203, Univ. of Chicago.

Seeds ovoid-ellipsoid, angular, 8–10 mm. long, 6–7 mm. in diameter, reticulate-pitted, dark brown. Embryo straight, 8 mm. long; cotyledons widely elliptic, 3.5 mm. long.

Distribution: Colombia, Panama.

Additional specimens:

COLOMBIA: Departamento del Chocó. *J. A. Duke 11351*, Hydro Camp No. 14, Rio Salaquí, 6 days upstream from Río Súcio, alt. ca. 200 m. 23 May 1967 (ECON).

PANAMA: Province de Darién. *N. Bristan 566*, Cerro Pirre. 11 Apr. 1967 (ECON, OSU). *Bristan 569*, same locality and date (ECON, OSU).

A very distinct species, ***Brunfelsia chocoensis*** has been named for the general geographic province in which it occurs. It is known from the northernmost part of the Chocó region of Colombia, an area bounded by the Serranía de Baudó in the west and the Serranía de Abibe in the east in the low lying basin of the Río Atrato. Its range extends north to Cerro Pirre across the Panamanian border. Although additional collecting may reveal a larger area for the species, *B. chocoensis* appears to be endemic at this low elevation in swampy forest. In 1945, it was reported as a common species at Chigorodó, the type locality. I failed to find the plant in a recent collecting trip to this locality, primarily because of the large scale destruction of the forests for agriculture and pasturage.

Brunfelsia chocoensis is most closely related to *B. guianensis* of the Guianas and northern Brazil. It differs in having much larger leaves, longer pedicels, and broader corolla lobes. *B. chocoensis* also resembles *B. macrocarpa*, a new species (described below) from the Pacific coast of northern Ecuador and Gorgona Island. *B. chocoensis* may be readily distinguished by its much smaller flowers and smaller fruits which lack the large, accrescent calyx

of *B. macrocarpa*. All three of these species are unique among South American Brunfelsias in having relatively large, fleshy fruits.

Data from herbarium labels (*N. Bristan 566* and *569*) indicate that the flowers of *Brunfelsia chocoensis*, which appear in April, are fragrant and that the yellow fruits are edible.

Brunfelsia macrocarpa *Plowman sp. nov.*

Arbor parva, 2–7 m. alta. Rami effusi, nudi, cortice laevi, cinerascenti. Ramuli flexuosi, glabri, interdum sparse lenticellis obtecti, epidermide ad longitudinem findenti. Folia sparsa ramulorum apicem versus, petiolata, late elliptica, plerumque oblonga, apice abrupte cuneata, glabra, chartacea, nervatione prominenti subtus, nervis lateralis 4–6, patentibus, arcuatim anastomosantibus, petiolo glabro. Inflorescentia ramulorum terminalis apicibus, uniflora, bracteata, bracteis paucis, lanceolatis, concavis, puberulentibus. Flores fragrantes, violacei demum albi. Pedicellus erectus, glaber. Calyx tubulosus, vix inflatus, dentibus subaequalibus, ovato-lanceolatis, apice acutis vel acuminatis, glandulosis: calyx in fructu persistens, magnopere accrescens, valde coriaceus, lenticellis punctiformibus obtectus. Corollae tubus quam calyx duplo longior, angulatus, apice parum curvatus et sensim dilatatus, glaber, limbo patenti, lobis rotundatis, subaequalibus, superiori parum majori. Stigma et stamina in tubi parte superiori inclusa, filamentibus ligulatis. Capsula calyci inclusa, late ovoidea vel subglobosa, ochracea, carnosa, pericarpio crasso, indehiscens. Semina 10–20, oblongo-ellipsoidea, prismatica, reticulato-foveata, atro-rufescentia.

A *Brunfelsia chocoensis* et *B. guianensis* floribus duplo majoribus calyce magnopere accrescenti et fructu majori differt.

Type: *E. L. Little & R. G. Dixon 21064*, Ecuador, Provincia de Esmeraldas, Río Hoja Blanca con Río Hualpi. Alt. 75 m. Árbol pequeña del sotobosque, de 7 m., 7 cm. d.a.p. Corteza lisa, gris. Corola morada, fruto comestible. Bosque húmedo primario. "Guayabilla". 14 Sept. 1965 (Holotype, GH; isotype, US 2639557).

Small tree 2–7 m. tall. Branches straggling, bare, with smooth greyish bark. Branchlets somewhat crooked, terete, 2–3 mm. in diameter, glabrous, yellowish brown, with epidermis splitting lengthwise, internodes 10–22 mm. long. Leaves sparse toward tips of the branchlets, petiolate, widely elliptic, occasionally oblong, at apex abruptly acuminate, the acumen often subfalcate, at base blunt or abruptly cuneate, blade 14–25 cm. long, 6.5–11.5 cm. wide, glabrous, chartaceous, dark green above, yellowish-green beneath, nervation prominent beneath, lateral nerves 4–6, spreading, arcuately anastomosing 5–10 mm. within margin, with reticulate veinlets; petiole subterete, canaliculate above, glabrous, 6–17 mm. long. Inflorescence terminal at the tips of the branchlets, one-flowered, bracteate. Bracts few, lanceolate, concave, 2–3 mm. long, puberulent. Flowers fragrant, showy, violet turning white with age. Pedicel erect, terete, thickened at apex, 8–10 mm. long, glabrous. Calyx tubular, ovate in bud, 20–22 mm. long, 6–8 mm. in diameter, weakly inflated, more or less punctate, firmly membranaceous, teeth subequal, ovate-lanceolate, 4–8 mm. long, acute to acuminate at apex, glandular-tipped; calyx in fruit persistent, greatly accrescent, 4–7.5 cm. long, to 4 mm. thick, coriaceous, somewhat shiny, with punctate lenticels. Corolla tube twice as long as calyx, cylindric, angled in cross-section, curved a little at apex and gradually widened, 40–45 mm. long, 3–5 mm. in diameter, glabrous; limb spreading, 50–55 mm. in diameter, glabrous, the lobes rounded, subequal, the uppermost a little larger, overlapping at sides, 18–22

BRUNFELSIA macrocarpa *Plowman*

Brunfelsia macrocarpa Plowman. 1, flowering branch, one-half natural size. 2, fruiting branch, one-half natural size. 3, seed excised to show embryo, one and one-half natural size. 4, fruit enclosed by calyx, cut-away view, one-half natural size. 5, limb of the corolla, two-fifths natural size.

mm. long. Stamens included in upper part of corolla tube, the filaments ligulate, curved at apex, the upper pair 2 mm. long, the lower 3 mm. long; anthers hippocrepiform, round in outline, 2 mm. in diameter. Ovary conical, 3 mm. long, glandular at base, with 30–40 ovules; style slender, curved and thickened at apex, 36–38 mm. long; stigma bifid, in form of a forceps, gaping, the upper lobe larger, 2 mm. long. Capsule included in accrescent calyx, broadly ovoid or subglobose, 4–5 cm. long, 4–5 cm. in diameter, smooth, yellow-ochre, one-celled at maturity, pericarp 6–8 mm. thick, the exocarp leathery, mesocarp fleshy, thick, endocarp thin, cartilaginous, conspicuously veined, with 10–20 seeds. Seeds oblong-ellipsoid, prismatic, 10–13 mm. long, 5–7 mm. in diameter, reticulate-pitted, dark reddish-brown. Embryo straight, 10–11 mm. long; cotyledons broadly ovate, 4–5 mm. long.

Distribution: Ecuador, Gorgona Island (Colombia).

Additional specimens:

Colombia: Departamento de Nariño, Gorgona Island. *G. W. Barclay 911*, 11–14 Jan. 1837 (BM). *A. Fernández 365*, Costado Oriental. 21 June 1950 (US). *G. Longfield 367*, 7 Sept. 1924 (K).

Known from only four collections, this beautiful treelet occurs in the Island of Gorgona which lies just off the Pacific coast of southern Colombia. It has also been collected quite recently in the coastal forests of northern Ecuador. *Brunfelsia macrocarpa*, named for its exceptionally large fruit, grows near sea level as a small tree of the understory in primary forests. The large, showy flowers are said to be fragrant with the odor of honeysuckle (*Longfield 367*). The fleshy yellow fruit is edible and bears the common name *guayabilla* or "little guava", which it resembles.

This species most closely resembles *Brunfelsia choco-*

ensis and *B. guianensis*. *B. macrocarpa* differs in having flowers which are twice as large and violet, not white, at anthesis. It is further distinguished by the large, accrescent calyx.

Brunfelsia Chiricaspi *Plowman sp. nov.*

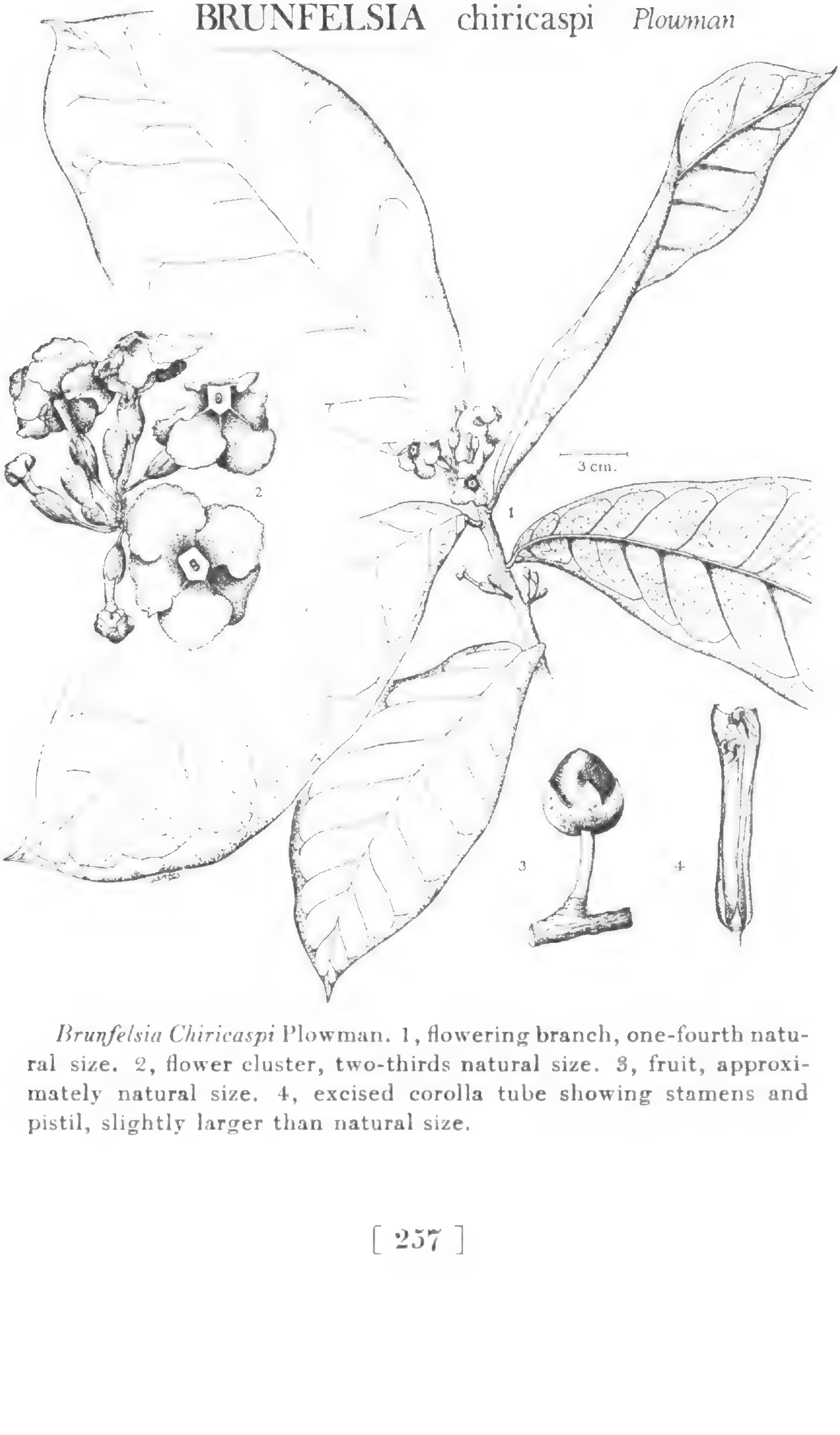
Frutex vel arbor parva 1–3 m. alta, cortice tenui, longitudinaliter fisso, ruguloso. Rami pauci, laxi, patentes, nudi. Ramuli glabri, nitidi, epidermide in fragmentis longitudinaliter solubili. Folia breve petiolata, oblonga vel lanceolata, plerumque obovata, apice acuminata vel obtusa, acumine subfalcato, basi cuneata vel obtusa, glabra, subcoriacea, subtus siccitate ochracea, nervis lateralibus 8–10, subtus prominentibus; petiolo crasso. Inflorescentia corymbiformis, terminalis vel axillaris, pauciflora, floribus 4–7 (raro 20), puberula vel glabra, bracteata, bracteis lanceolatis, concavis. Pedicellus erectus, glaber. Calyx tubuloso-campanulatus, vix inflatus, glaber, dentibus brevis, late triangularibus, acutis vel obtusis apice acumine breve glanduliferis; calyx in fructu lenticellis obtectus, nervis striatis. Corollae tubus quam calyx duplo longior, crassus, rectus, apice parum dilatatus, vix curvatus, glaber, limbo caeruleo vel violaceo demum albo, ad orificium parum incrassato, quinquangulari, albo, lobis subaequalibus, rotundatis, sub anthesi valde deflexis. Stamina et stigma in tubi parte superiori inclusa. Capsula subglobosa, maturitate sicca. Semina pauca, ellipsoideo-reniformia.

A *Brunfelsia Mire* foliis oblongo-lanceolatis, cyma pauciflora et corolla minori et a *B. grandiflora* foliis majoribus, cyma corymbiformi et lobis corollae deflexis differt.

Type: *G. Klug 1810*, Colombia, Comisaría del Putumayo, Umbría, 0°54′ N., 76°10′ W., alt. 325 m.; forest. Oct.–Nov. 1930. Shrub 1.5 m. Fls. sky blue. "Zanango". Medicinal. (Holotype, A; isotypes, F, S, US 1456539.)

Shrub or treelet 1–3 m. tall. Trunk to about 5 cm. in diameter near base. Bark thin, cracked lengthwise, roughish, greyish brown. Branches few, lax, spreading, naked. Branchlets subterete, 5–6 mm. in diameter, glabrous, light brown to ochraceous, shiny, outer bark thin, splitting longitudinally and shedding in thin flakes, internodes mostly 1–3 cm. long. Leaves scattered along branchlets or somewhat crowded, short petiolate, elliptic to lanceolate, sometimes obovate, apically obtuse with short, subfalcate acumen or acuminate, cuneate to obtuse at base, blade 20–30 cm. long, 7–12 cm. wide, glabrous, smooth, subcoriaceous, dull, dark green above, pale green beneath, lateral nerves 8–10, straight, spreading, arcuately anastomosing 2–8 mm. within margin, veinlets more or less conspicuous, reticulate; petiole short, stout, subterete, 5–10 mm. long, canaliculate above, glabrous, dark brown, roughish. Inflorescence corymbiform, terminal or axillary, usually few-flowered with 4–7 (rarely 20) flowers, puberulent or glabrous, bracteate. Bracts lanceolate, concave, 1–2 mm. long, glabrous. Pedicel slender, terete, erect, 6–13 mm. long, glabrous. Calyx tubular-campanulate slightly inflated, 10–13 mm. long, 4–6 mm. in diameter, subcoriaceous, glabrous, teeth short, broadly triangular, acute to blunt with short glandular acumen; calyx in fruit coriaceous, striately nerved, dotted with lenticels, to 13 mm. long. Corolla tube twice as long as calyx, cylindric, straight, fleshy, slightly dilated and curved at apex, 22–25 mm. long, 3 mm. in diameter, glabrous; limb 25–30 mm. across, glabrous, sky blue to violet, fading to white, thickening at mouth prominent, fleshy, 5-angled, white, lobes subequal, the uppermost slightly larger, rounded, abruptly narrowed at base, strongly deflexed at anthesis. Stamens inserted in upper part of corolla tube; filaments subligulate, curved at apex, lower inner pair 2.5 mm. long, upper

BRUNFELSIA chiricaspi *Plowman*



Brunfelsia Chiricaspi Plowman. 1, flowering branch, one-fourth natural size. 2, flower cluster, two-thirds natural size. 3, fruit, approximately natural size. 4, excised corolla tube showing stamens and pistil, slightly larger than natural size.

outer pair 3.5 mm. long, reaching the mouth; anthers rounded-reniform, to 1.5 mm. long, light brown. Ovary ovoid-conical, gibbous at base, 2 mm. long with about 15 ovules; style filamentous, curved at apex, equalling the filaments; stigma bifid, in form of a forceps, obtuse, the upper lobe somewhat larger. Capsule dry at maturity, subglobose, about 10 mm. long, 8 mm. in diameter. Seeds few, ellipsoid-reniform, 6 mm. long, 2.5 mm. in diameter, reticulate-pitted.

Distribution: Colombia.

Additional specimens:

COLOMBIA: Comisaría del Putumayo. *H. Kennedy 1386*, Orito, near Texaco Drilling Site. 11 Feb. 1972 (GH). *L. E. Mora 1048*, alrededadores de Puerto Limón. Alt. 300–400 m. 15 Feb. 1953 (COL). *H.V. Pinkley 420*, San Antonio del Río Guamués. Lomas. 5 Sept. 1966 (ECON). *Pinkley 563*, Santa Rosa del Río Guamués. 28 Nov. 1966 (ECON). *T. Plowman 2080*, El Whiskey at Finca 'Santa Marta', 13 km. south of Umbría near road. Elev. 400–500 m. 27 Nov. 1968 (ECON, GH). *Plowman 2081*, forest about 2 km. southwest of San Pedro, north of Puerto Asís. Elev. 400–500 m. 28 Nov. 1968 (ECON, GH). *Plowman 2092*, Río Guamués, along trail between Santa Rosa and road to Hormiga. 2 Dec. 1968 (ECON, GH).

The specific name of this plant is taken from one of its vernacular names: *chiricaspi*, meaning "cold tree" in Quechua. This word refers to the physiological effect of chills or tingling produced upon ingestion of the bark. This, as well as other species of Brunfelsia, is used by the Kofán, Inga and perhaps other tribes of southern Colombia as an admixture to the hallucinogenic *Banisteriopsis*. It is reputedly the strongest of the intoxicating Brunfelsias. Known only as a wild plant, it is preferred over the commonly cultivated *Brunfelsia grandiflora* subsp. *Schultesii* (described below).

Brunfelsia Chiricaspi is known from only a few collections. It occurs in a small area of southwestern Colombia on the eastern flank of the Cordillera Occidental. Its

distribution may indeed prove to be greater when this region is floristically better known. It grows as a understory shrub in humid, primary forests at elevations of 325–500 m., occasionally persisting after cutting of the forest. The fruit is as yet imperfectly known. The only fruit material available to me was in an advanced state of decay at the time of collection.

This species appears to be quite distinct. Its closest relatives are *Brunfelsia grandiflora* subsp. *Schultesii*, which is widespread in the western Amazon, and *B. Mire* of Bolivia. *B. Chiricaspi* differs from *B. grandiflora* in having much larger leaves (more than 20 cm.), longer pedicels (6–13 mm. vs. 2–6 mm.), a few-flowered corymbiform cyme and deflexed corolla lobes, which is perhaps the most striking feature of the species. It differs from *B. Mire* in the basally obtuse, elliptic to lanceolate leaves, the few-flowered cyme and a much shorter corolla tube (less than 25 mm.).

Brunfelsia grandiflora subsp. **Schultesii** *Plowman subsp. nov.*

Frutex vel arbor parva 1–5 m. alta. Rami graciles, arcuati, foliosi, cortice tenui longitudinaliter fisso, solubili. Ramuli glabri, epidermide in fragmentis solubili. Folia variabilia, plerumque lanceolata, oblonga vel elliptica, apice longe acuminata, acumine subfalcato, basi obtusa, cuneato-angustata, glabra, nervis lateralibus 5–9, patentibus, arcuatim anastomosantibus; petiolo crasso, breve. Inflorescentia variabilis, terminalis et subterminalis, plerumque ramosa, bracteata, 3- usque ad multiflora, bracteis parvis, lanceolatis, caducis. Pedicellus crassus, brevis. Calyx tubuloso-campanulatus, saepe basin angustatus, persistens, dentibus triangularibus vel ovato-triangularibus, acutis vel obtusis cum acumine breve. Corollae tubus quam calyx duplo longior, rectus,

parum inflatus in tertia parte superiori deinde ad orificium constrictus, glaber, limbo patenti, violaceo deinde albo, ad orificium parum incrassato, obovato-rotundato, albo, lobis subaequalibus, rotundatis. Stamina et stigma in tubi parte superiori inclusa. Capsula ovoideo-conica, obtusa vel mucronata, pericarpio tenui, siccitate chartaceo-crustacea. Semina 10–20, oblongo-reniformia, aliquantulum angulata.

A subsp. *grandiflora* floribus et fructibus minoribus, tubo corollae rectior et annulo fauci obovato differt.

Type: *R.E. Schultes, R.F. Raffauf & D. Soejarto 24108*, Colombia, Comisaria de Amazonas, Rio Amazonas, near mouth of Rio Loretoyacu and Puerto Nariño. "Bush 12 ft. Flowers white or purple. Poisonous to cattle. *Sanango*. Alkaloid: very positive. 13–15 Sept. 1966 (Holotype, GH; Isotype, ECON).

Shrub to small tree 1–5 m. tall, often branched from near base. Branches slender, ascending then spreading, often arching, subterete, glabrous, leafy. Bark thin, light brown, shining, splitting lengthwise, then crosswise, the outer layer shedding in thin flakes. Branchlets glabrous, 1–3 mm. in diameter, green to yellowish brown, epidermis cracking longitudinally, internodes 1–3 cm. long. Leaves more or less two-ranked, scattered along branchlets, lanceolate, oblong or elliptic, apically long acuminate, the acumen subfalcate, basally obtuse to narrow cuneate, 6–20 cm. long, 2–8 cm. wide, glabrous, thick membranaceous to subcoriaceous, dark green above, pale green beneath, usually dull, nervation more or less prominent beneath, lateral nerves 5–9, spreading, arcuate, anastomosing within margin, veinlets finely reticulate; petiole short, stout, 2–6 mm. long, subterete, canaliculate above, glabrous, rarely puberulent. Inflorescence variable, terminal or subterminal, compact or lax, usually branched, rachis 10–40 mm. long, bracteate, glabrous, 3- to many-flowered. Bracts small, lanceolate,

BRUNFELSIA grandiflora *D. Don*

Brunfelsia grandiflora subspecies *grandiflora*, upper right. Subspecies *Schultesii*, center left including seeds. 1, seed showing surface texture, three times natural size. 2, seed showing embryo, same magnification.

1–4 mm. long, sparsely pubescent to glabrous, caducous. Pedicel erect, terete, mostly 2–6 mm. long, glabrous, thickening in fruit with punctate lenticels. Calyx tubular-campanulate, more or less inflated, often narrowed at base, 5–10 mm. long, firmly membranaceous to subcoriaceous, persistent, teeth triangular to triangular-ovate, apically acute or blunt with short acumen, minutely glandular-tipped, 1–3 mm. long; calyx in fruit coriaceous, with corky, punctate lenticels, partially enclosing fruit at base or splitting away. Corolla tube twice as long as calyx, cylindric, usually straight, inflated in upper third, then constricted at mouth, 15–30 mm. long, 1–2 mm. in diameter, glabrous; limb spreading, 20–40 mm. in diameter, violet, becoming white with age, thickened into fleshy ring at mouth, obovate, 3–5 mm. long, white or yellowish, the lobes subequal, rounded at apex, rarely emarginate, overlapping at sides, narrowed toward base, 7–10 mm. long. Stamens included in upper third of tube; filaments curved at apex, upper pair about 4 mm. long, lower pair 3 mm. long, glabrous; anthers orbicular in outline, to 1.5 mm. in diameter. Ovary conical-ovoid, slightly gibbous at base, to 2 mm. long; style slender, curved at apex; stigma included between anthers, short, bifid, in form of a forceps, obtuse, the upper lobe somewhat larger. Capsule ovoid to subglobose, obtuse or mucronate, 11–16 mm. long, 10–16 mm. in diameter, thin-walled, shiny, dark green to brownish, with punctate lenticels, drying chartaceous, tardily dehiscent, with 10–20 seeds. Seeds ellipsoid-oblong, more or less angular, 4–6 mm. long, 2–3 mm. in diameter, reticulate-pitted, dark reddish-brown. Embryo 4 mm. long, slightly curved; cotyledons ovate-elliptic, 1.5 mm. long.

Distribution: Venezuela, Colombia, Ecuador, Peru, Bolivia, Brazil.

Additional specimens:

Venezuela: Estado Barinas: *L. Aristeguieta 1669*, Barinitas, Mar. 1953 (NY, VEN).

Colombia: Departamento de Meta: *M. T. Dawe 241*, forests of llanos of San Martin. 30 Sept. 1916 (K, US). Departamento de Caquetá: *E. Pérez-Arbeláez 688*, Florencia, alt. 420 m. Feb. 1930 (COL, US). *S. Vogel 24*, La Rastra, Río Orteguaza. 22 Apr. 1956 (US). Comisaría del Putumayo: *J. Cuatrecasas 10795*, selva higrófila del Río Putumayo en Puerto Ospina. 230 m. alt. 25 Nov. 1940 (COL, US). *H. Garcia-Barriga 4586*, Camino entre Mocoa y Puerto Asís. Alt. 500 m. 21 Jun 1935 (COL, US). *T. Plowman 2090*, Rio Guamués, along trail between San Antonio and Santa Rosa. 1 Dec. 1968 (ECON, GH). Comisaría de Amazonas, *T. Plowman & H. Kennedy 2310*, Leticia, 1 km. NE of town along road to brick factory. 30 Jan. 1969 (ECON, GH).

Ecuador: Provincia Oriente: *E. Heinrichs 496*, Rocafuerte, high forest of Hacienda(Arcadia, Río Curaray, 200 m. 7 Jul 1933 (F, G). Provincia Napo: *H.V. Pinkley 575*, Río Aguarico, Dureno. 8 Dec. 1966 (ECON).

Peru: Departamento de Loreto: *E.P. Killip & A.C. Smith 28056*, Yurimaguas, lower Río Huallaga, alt. about 135 m. Woods. 22 Aug.–9 Sept. 1929 (NY). *G. Klug 2880*, Balsapuerto, alt. 220 m. Forest. Feb. 1933 (A, F, G, GH, MO, NY, PH, S, UC, US). *T. Plowman 2533* Río Nanay, forest near Chiriara. 21 Feb. 1969 (ECON, GH). *J. Schunke 8*, Gamitanacocha, Río Mazán. Alt. 100–125 m. 12 Jan. 1935 (A, F, NY, UC, US). *G. Tessmann 3243*, Prov. Ucayali, lower Pisqui, Nueva Beliza. 1923 (G, NY, S). *Tessmann 5005*, Río Marañón, Pongo de Manseriche. 1924 (G). Departamento de San Martin: *C.A. Belshaw 3130*, Dist. San Martín, west side of Rio Huallaga, south of Shapaja 1–4 km. Alt. 900 ft. 28–30 Jul. 1937 (NY, UC, US). *G. Klug 3326*, Zepelacio near Moyobamba. Alt. 1100–1200 m. Forest. Oct.–Nov. 1933 (A, F, G, GH, MO, NY, S). *R. Spruce 3973*, near Tarapoto, 1855–1856 (BM, BR, CGE, G, K, MG, NY, W). Departamento de Cuzco: *C. Vargas 16301*, Prov. Paucartambo. Villa Carmen. 720 m. Bosque. 1 May 1965 (US). Without locality: *Matthews 1320*, 1835 (CGE, K).

Bolivia: Departamento de Pando: *E. Ule 9748*, Río Acre, Cobija, Jan. 1912 (G, K, MG). Departamento de Beni: *O.E. White 2386*, Río Iboy, Beni. Alt. 800 ft. 14 Feb. 1922 (NY, US). Departamento de La Paz: *M. Bang 1398*, Guanai-Tipuani, Bolivian Plateau, Apr.–Jun. 1892 (A, BM, F, G, GH, K, M, MICH, MO, NY, PH, R, US, W). *H.H. Rusby 621*, Mapiri, 5000 ft. Apr. 1886 (BM, G, GH, K, LE, MO, NY, PH, US, W). *R.S. Williams 475*, Tumupasa. 1800 ft. 7 Jan. 1902 (BM, NY, US). Departamento de Santa Cruz: *J.*

Steinbach 7936, Prov. Ichilo, Buenavista. 450 m. 15 Feb. 1928 (A, BM, F, K).

Brazil: Estado Amapá: *H.S. Irwin et al. 47359*, Río Oiapoque, in shade of virgin forest, 5 km. southeast of Clevelandia, 3°48′ N, 51° 53′ W. 5 Aug. 1960 (MG, NY). Estado Amazonas: *A. Ducke 865*, Esperança at mouth of Rio Javary, non-inundated forest. 26 Jan. 1942 (F, GH, MG, MO, R, US). *J. Huber 4204*, Río Purús, Cachoeira, várzea. 21 Mar. 1904 (MG). *J.W.H. Traill 599*, Upper Amazon and tributaries, in forest, near Tabatinga. 30 Nov. 1874 (K, P). Estado Acre: *E. Ule 9746*, Rio Acre, Seringal, Paraguassú. Nov. 1911 (K, MG). *Vasconcelos, D. Coelho s.n.*, Río Branco, terra firme. 26 Feb. 1962 (INPA).

This new subspecies has been named for Professor Richard Evans Schultes of Harvard University, co-collector of the type and long-time student of the Amazonian flora. His profound interest in hallucinogenic plants is appropriately commemorated by this beautiful shrub which is now known to be employed extensively by tribes of the upper Amazon to prepare vision-producing drinks.

Brunfelsia grandiflora subsp. *Schultesii* has long been recognized in the literature under a variety of misapplied names, including *B. bonodora* (Vell.) Macbride, *B. latifolia* (Pohl) Benth., and *B. maritima* Benth. It is now clear that these epithets all apply to other species which occur only as local endemics in southeastern Brazil. This new concept is very closely related to *B. grandiflora* D. Don. and must be considered its subspecies.

Subspecies *Schultesii* is wide-ranging and polymorphic, occurring in western South America from Venezuela south to Bolivia. In addition, an anomalous population is known from Territory of Amapá in northern Brazil. It grows commonly as an understory shrub in primary and secondary forests between 100 and 900 m. elevation. Since this subspecies is widely cultivated for medicinal and ornamental purposes, some activity of man has undoubtedly influenced its present distribution.

Plate XIX

Habit and habitat of *Brunfelsia grandiflora* subsp. *Schultesii* (slender tree at the man's left arm).

The two subspecies of *Brunfelsia grandiflora* differ primarily in the size and form of the flowers and in the size of the fruits. Subspecies *Schultesii* tends to be smaller also in habit and leaf size, but there is considerable overlap between the subspecies in these characters.

The following key will serve to separate the two concepts:

A. Corolla tube usually curved toward the apex, 30–45 mm. long, 2–3.5 mm. in diameter, opening at mouth linear-oblong; limb 35–42 mm. in diameter; capsule 17–22 mm. long
subsp. *grandiflora*

AA. Corolla tube usually straight, 18–30 mm. long, 1–2 mm. in diameter, opening at mouth elliptic-obovate; limb 20–40 mm. in diameter; capsule 10–16 mm. long. . . . subsp. *Schultesii*

These two subspecies are both ecologically and geographically isolated. The typical subspecies is usually found between 900 and 2000 m. elevation in the inter-Andean valleys of the Ríos Marañon, Huallaga and Ucayali; subspecies *Schultesii* normally occurs at much lower elevations between 100 and 900 m. throughout the upper Amazon and its tributaries, although isolated populations in Bolivia may reach 1800 m. From morphological and geographical evidence, it appears that subsp. *grandiflora* has arisen from its much more widespread and variable counterpart through isolation in the intermontane valleys.

Meiotic chromosome numbers have been obtained for the subspecies of *Brunfelsia grandiflora*. These indicate that $n = 11$ for both subspecies, a number in keeping with other known counts in the genus.

$n = 11$ *Brunfelsia grandiflora* subsp. *grandiflora*, *T. Plowman 2960*, USA, Florida, Miami. Cultivated at Fantastic Gardens, 25 Nov. 1970 (ECON, INPA).

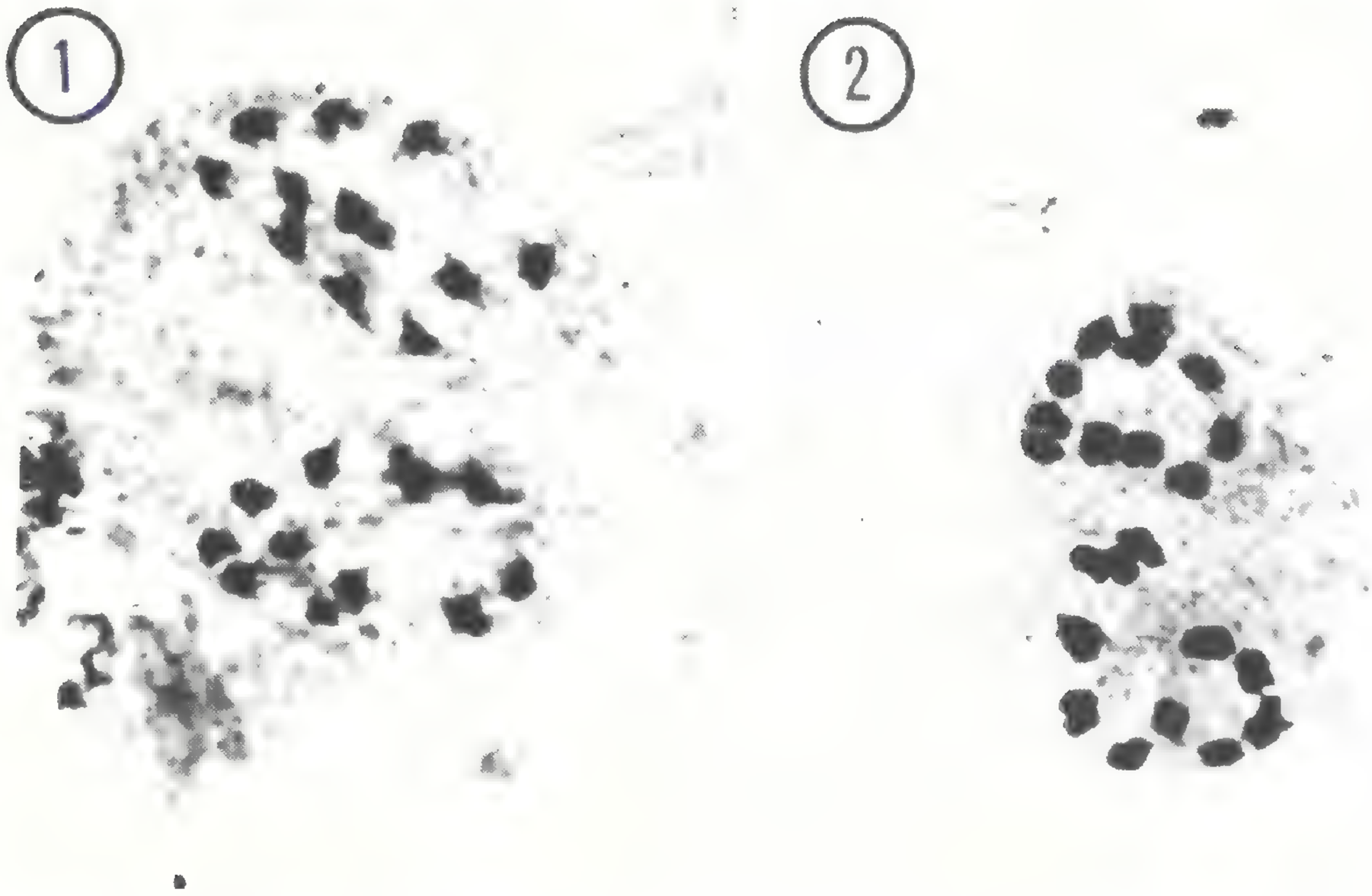
$n = 11$ *Brunfelsia grandiflora* subsp. *Schultesii*, *T. Plowman et al. 2404*, Colombia, Comisaría de Amazonas, Río Amazonas, near mouth of Río Loretoyacu and Puerto Nariño. 5 Feb. 1969 (GH).

Brunfelsia grandiflora subsp. *Schultesii* is closely related to and often confused with *B. bonodora* and *B. latifolia* (also designated as *B. maritima*), both indigenous to the State of Rio de Janeiro, Brazil. *B. latifolia* is a low shrub restricted to the maritime *restinga* vegetation around Rio de Janeiro. It differs from *B. grandiflora* mainly in having longer pedicels (6–12 mm. vs. 2–6 mm.) and leaves which are apically blunt or acute, not long acuminate. *B. bonodora* is a very rare plant, known from only a few collections in the Serra dos Orgãos. It closely resembles *B. grandiflora* subsp. *Schultesii* in several characters but may be distinguished by its longer pedicels (6–12 mm.) and smaller capsule which is nearly enclosed by the persistent calyx.

Brunfelsia grandiflora subsp. *Schultesii* is known by a variety of common names, including *sanango*, *chiric sanango* (Peru), *chiricaspi* (Colombia) and *bella unión* (Bolivia). The Quechua word *chiric* means "cold" and, as with *B. Chiricaspi*, refers to the sensation of chills produced upon ingestion of the plant. Like subspecies *grandiflora* and *B. Chiricaspi*, this plant is widely used throughout the western Amazon as both a medicine and narcotic. The bark or roots are frequently added to preparations of *ayahuasca* or *yagé* (*Banisteriopsis Caapi*), a strong hallucinogen in itself, to produce sensations of chills or tingling in the extremities. As a medicine, it is a commonly used remedy against rheumatism and arthritis. The active constituents of this pharmacodynamic species are as yet unknown. Although some studies have been made by pharmaceutical firms, the results remain unpublished. The label on the type collection indicates that alkaloids may be present in the plant.

The following key is offered to distinguish the concepts of *Brunfelsia* found in western South America:

Plate XX



Chromosome squashes of first meiotic divisions in *Brunfelsia grandiflora:* 1, subsp. *grandiflora*, T. Plowman 2960, ×1000. 2, subsp. *Schultesii*, Plowman et al. 2404, ×1000.

A. Flowers 1–3 per inflorescence . . . . . B.
B. Leaves less than 12 cm. long, capsule dry or thickly coriaceous at maturity, green or brown . . . . . C.
C. Corolla tube 1.3–2.5 cm. long; capsule thin-walled, not grooved, 0.7–1.8 cm. long; Bolivia, eastern Brazil and Venezuela . . . . . *B. uniflora*
CC. Corolla tube 3–4 cm. long; capsule thick-walled, leathery, four-grooved, 1.5–2.5 cm. long; Panama . . . *B. Dwyeri*
BB. Leaves usually more than 14 cm. long, capsule fleshy at maturity, yellow . . . . . D.
D. Corolla tube 2.2–2.7 cm. long; capsule 2–3 cm. long; calyx not accrescent in fruit; Colombia, Panama . . . . . *B. chocoensis*
DD. Corolla tube 4–4.5 cm. long; capsule 4–5 cm. long; calyx strongly accrescent in fruit; Ecuador, Colombia . . . . . *B. macrocarpa*
AA. Flowers 5- to many per inflorescence. . . . . E.
E. Leaves usually oblanceolate, subverticellate; inflorescence many-flowered, dense, capituliform; Bolivia, Peru, Brazil . . . . . *B. mire*
EE. Leaves oblong-lanceolate, usually scattered; inflorescence mostly few-flowered, lax or corymbiform . . F.
F. Leaves usually more than 20 cm. long; pedicels 6–13 mm. long; corolla lobes deflexed at anthesis; Colombia . . . . . *B. Chiricaspi*
FF. Leaves usually less than 20 cm. long; pedicels 2–6 mm. long: corolla lobes spreading . . *B. grandiflora*
1. Corolla tube 3–4.5 cm. long; capsule 1.7–2.2 cm. long; Peru, Ecuador, Brazil . subsp. *grandiflora*
2. Corolla tube 1.8–3 cm. long; capsule 1.1–1.6 cm. long; Venezuela to Bolivia, Brazil subsp. *Schultesii*

Acknowledgments

I would like to express my thanks to the curators of herbaria who have graciously lent specimens cited in this paper. Abbreviations of herbaria are taken from Index Herbariorum (Lanjouw and Stafleu, 1964). I am grateful to Dr. William T. Gillis and Professor Richard E. Schultes for additions and comments on the manuscript and to Dr. Leslie Garay for assistance with the Latin descriptions. I am especially indebted to Dr. Alice F. Tryon who kindly lent the use of her microscope for photographing cytological specimens. Finally, I want to thank Lynda Bates who made the beautiful line drawings which accompany the text.

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GENERIC RECOGNITION OF BRUGMANSIA

BY

TOM E. LOCKWOOD*

An Historical Review

The question of whether the South American *floripondios* should be regarded as a subgenus or section of *Datura* or accorded generic rank as *Brugmansia* has long been a matter of debate among taxonomists. The precedent for their being placed in *Datura* was established by Linnaeus (14) in 1753 with the naming of *Datura arborea*. Following Linnaeus' example, Ruíz and Pavón (16), in their *Flora Peruviana* of 1799, described a new species of floripondio as *D. sanguinea* and incorrectly described another member of the genus as Linnaeus' *D. arborea*. The description of this misidentified plant was used by Persoon (15) in 1895 as the basis for *Brugmansia candida*. Persoon distinguished the two genera on differences in fruit and flower morphology as well as habit.

Persoon's treatment did not meet with universal acceptance. Bernhardi (3) pointed out in 1833 that some of the characters used by Persoon for segregating *Brugmansia* were to be found in *Datura ceratocaula*—a unique semi-aquatic species indigenous to Mexico. The "linking" characters of this species, as listed by Bernhardi,

* Botanical Museum, Harvard University.

have been cited consistently by later taxonomists as their major reason for retaining *Brugmansia* as a section or subgenus of *Datura*. The relative taxonomic value of these characters will be discussed below.

After what appears to have been some initial uncertainty as to whether or not he should use *Brugmansia* or *Datura* in describing a new species in 1893, Lagerheim (12,13) in 1895 published a monograph of the Ecuadorean species of *Brugmansia* in which he left no doubt that he accepted Persoon's view that the two genera were morphologically distinct. Although he made several mistakes in his identifications, Lagerheim's work was the most complete study of the Brugmansias up to that time and was based on many years of field experience in Ecuador and Peru.

In his monograph, Lagerheim also drew attention to the fact that Blume's (6) use in 1828 of the name *Brugmansia* for a new genus in the Rafflesiaceae was illegitimate, because Persoon's genus in the Solanaceae enjoyed priority. Blume's use of the name *Brugmansia*, however, prompted van Zijp (20) in 1920 to propose the new generic name *Pseudodatura* for the solanaceous genus. This was done, apparently in ignorance of Lagerheim's work, because van Zijp's stated reason for proposing the new generic name was the long disuse and wide non-acceptance of Persoon's name and its new use by Blume in the Rafflesiaceae. As was pointed out by van Steenis (19), long disuse or non-acceptance by some botanists does not invalidate a name. Van Steenis agreed with Persoon and Lagerheim that the character differences between *Brugmansia* and *Datura* justified a generic separation.

More recent workers such as Safford (17), DeWolf (10), Barclay (2), Danert (9), and Bristol (7) have considered the Brugmansias as part of *Datura* following the

arguments of Bernhardi (3) that *Datura ceratocaula* forms an intermediate link between the two.

Character Differences

The primary anatomical-morphological differences between *Brugmansia* and *Datura* are listed in Table 1. Although both genera may reasonably be regarded as "weedy" plants adapted to disturbed situations and to have shared a common ancestor or ancestors, it appears from an examination of their character differences that they have evolved as a result of very different ecological pressures.

The characters that distinguish *Datura* (with the exception of *Datura ceratocaula*) are excellent examples of adaptations to a xeric environment: an annual or short-lived perennial life cycle, herbaceous habit, self-compatibility, the major part of the plant given over to inflorescence, and fruits that are dry, spiny, and dehiscent. These characters are consistent with the idea that Mexico and the southwestern United States is the center of origin and evolution of the Daturas where, during the Tertiary, they underwent rapid adaptive radiation in response to developing desert environments.

Evolving in the mesic conditions of the northern Andes, the Brugmansias retained several characters which are considered primitive relative to *Datura*. Among these characters are the bilocular ovary, self-incompatibility, and the long-lived perennial condition. It seems likely that the Brugmansias also experienced a period of adaptive radiation during the late Tertiary as the Andes underwent their last and major orogeny, opening a wealth of newly disturbed habitats suitable for invasion. Under these conditions, they developed the arborescent habit, secondary woodiness, the ability to reproduce extensively by root-suckering, pendulous flowers adapted

TABLE 1*

MORPHOLOGICAL COMPARISON OF *DATURA* AND *BRUGMANSIA*

Datura	*Brugmansia*
Habit, Growth, Form and Longevity	
Herbaceous annuals or short-lived perennials which die back to their roots.	Woody, relatively long-lived arborescent shrubs or small trees, producing vascular cylinders of considerable size.
Vegetative axes restricted to the basal portions of the plant.	The vegetative axes not limited to the basal portions.
Branching restricted to the inflorescence.	Branching not restricted to the inflorescence.
Plants lacking an effective means of vegetative reproduction.	Plants reproducing vegetatively by root suckers and forming sizable clones.
Inflorescence	
Inflorescence predominantly dichasial.	Inflorescence predominantly monochasial.
Inflorescence is localized to the upper portions of the plant, and once initiated does not revert to vegetative growth.	Inflorescence not localized and reverts to a vegetative axis at the end of flowering.
The major part of the plant is inflorescence.	The major part of the plant is not inflorescence.
Flower	
Flowers borne in an erect position.	Flowers pendulous or inclined, never erect.
Flowers closing during the day and opening in the evening.	Flowers remaining open during the day and throughout anthesis.
Anthesis one or two days.	Anthesis four to six days.
Calyx not spathe-like except in *Datura cerotocaula*, the calyx teeth usually separating more or less equally.	Calyx frequently spathe-like or split along more than one side due to the failure of the calyx teeth to separate.

* After Barclay (*2*) with modifications.

TABLE 1 (continued)

Flower	
Calyx circumscissile near the base and falls away with the corolla, the persistent base ultimately forming a membranous disk, cup or reflexed frill subtending the mature fruit.	Calyx not circumscissile, either falling away entirely or forming a persistent husk-like structure around the mature fruit.
Fruit	
Fruit a relatively small, dehiscent berry or capsule borne on short pedicels in an erect, suberect or nodding position.	Fruit a large pendulous berry borne on much elongated pedicels.
Bicarpellate and tetralocular due to presence of false septa.	Bicarpellate and bilocular owing to the lack of false septa.
Fruit in most species possessing a dehiscence mechanism.	Fruit lacking any dehiscence mechanism.
Pericarp usually spinose.	Pericarp smooth and unarmed.
Seeds	
Seeds relatively small and lacking a corky seed coat.	Seeds large and most species with a thick, corky seed coat.
Seeds usually with a well developed funicular caruncle.	Seeds lacking a caruncle.

to hummingbird pollination, and fruits that are large and fleshy. The derived nature of these characters would seem to preclude the possibility of *Brugmansia* being ancestral to *Datura*.

The unique combination of characters of *Datura ceratocaula* has caused Bernhardi (3), Safford (17) and others to consider it a connecting link between *Brugmansia* and *Datura*. The plant is an herbaceous annual with erect flowers, a circumscissile calyx, a tetralocular ovary, and carunculate seeds. These are all characters typical of *Datura*. It differs from other species of *Datura*, however, in having a smooth, fleshy fruit and from all other

species of both *Datura* and *Brugmansia* in being semi-aquatic.

The main character of interest is the fruit, which is essentially the "connecting link". Various taxonomists have described the fruit as a fleshy berry; as a fleshy, dehiscent berry; and as a smooth, irregularly opening capsule. Observations on plants grown in the Experimental Garden at Harvard University agree with those of Blakeslee's group (1) that the fruits are smooth, fleshy capsules which dehisce by irregular, longitudinal splitting of the pericarp into segments that curl back and break apart. It was observed also, in the cultivated plants at Harvard, that an abscission layer forms around the base of the fruit. After the initial splitting of the pericarp, this abscission layer causes the whole fruit to fall from the plant (Plate XXI). The fruits of *Datura ceratocaula* are somewhat reminiscent of the smooth-capsuled "quercina" and "inermis" mutants of *D. Stramonium;* however, they are morphologically and anatomically unrelated to the fruits of *Brugmansia.* Rather than viewing *Datura ceratocaula* as a primitive, connecting link between *Datura* and *Brugmansia*, it seems more appropriate to view it as a highly specialized *Datura.* The hollow stem, weak root system, and reduced vascular tissue are obvious specializations for its semi-aquatic habit. The possible advantages of a fleshy fruit are not as apparent; however, a dry, spiny capsule would be of less advantage here than in a xeric environment. With these specializations, *D. ceratocaula* has exploited an ecological niche unavailable to other species of *Datura* and makes it difficult to interpret them as representing primitiveness.

Due to the presence of various natural crossability barriers, it is rare to find *Datura* hybrids in the field. In the laboratory, however, most species can be hybri-

Datura ceratocaula showing dehiscence of fruit.
(*Photograph by* JAMES B. NARDI)

dized and in those cases where complete incompatibility exist, such as *Datura ceratocaula*, hybrids have been obtained by embryo-dissection and culture (5, 18). Blakeslee (4) has found that in all *Datura* hybrids the degree of fertility varies; however, all the chromosomes show a high degree of synapsis during meiosis resulting in the formation of varying numbers of closed bivalents or multivalent configurations and a complete absence of univalents. These findings led him to conclude that the differences in the genomes of the various species are due mainly to reciprocal exchanges of the ends of the chromosomes without affecting much of their structural similarity.

Even with the use of the embryo culture technique, *Brugmansia* × *Datura* hybrids are extremely difficult to produce. Carson (8) in 1945 was able to make the hybrid *Datura inoxia* (female) × *Brugmansia suaveolens*, and Joshi (11) in 1949 the hybrid *D. inoxia* (female) × *B. aurea* (this was mistakenly identified by Joshi as *B. Rosei*). In both cases, the hybrids were completely sterile. Joshi's studies showed the presence of a large number of univalents and only a few bivalents during meiosis in these hybrids. He concluded that the extremely poor synapsis in the hybrids is indicative of great structural differences in the two parental genomes.

Conclusion

The question of whether *Brugmansia* should be regarded as a distinct genus or as a subgenus or section of *Datura* has long been a matter of debate among taxonomists. Evidence based on anatomical, morphological, ecological, and genetic considerations indicates that the two have evolved independently and no intermediate or ancestral forms are known to exist. The highly specialized semi-aquatic species *Datura ceratocaula* cannot be

regarded as intermediate between the two genera, nor do the many specializations of *Brugmansia* permit it to be regarded as the progenitor of *Datura*. On the basis of this evidence, *Brugmansia* merits generic rank.

SYNOPSIS OF BRUGMANSIA NOMENCLATURE

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A NEW SPIRANTHES FROM THE GRASSLANDS OF CENTRAL NORTH AMERICA

BY

CHARLES J. SHEVIAK*

The genus *Spiranthes* L. C. Rich. is highly complex and in eastern North America has caused some confusion among taxonomists and others who have had cause to determine occasional specimens. Many species are with difficulty separated from their allies, and apparent hybrids occur with sufficient frequency to obscure specific distinctions. Among the species most notorious for such behavior is *S. cernua* (L.) L. C. Rich. This species comprises various ecological and morphological races, at least some of which appear to intergrade and hybridize with other species. *Spiranthes cernua* has needed definitive study, but wide field experience is a prerequisite for such an undertaking, and, thus far, no one has attempted to clarify the situation. At present, two varieties in addition to the heterogeneous assemblage considered typical are frequently recognized.

Variety *odorata* (Nutt.) Correll differs from more typical *S. cernua* in its rhombic-ovate lip, stoloniferous roots, and its occurrence principally in coastal plain swamps. It is often appreciably more robust and foliose than typical *S. cernua*. This taxon has historically been treated as

* Botanical Museum, Harvard University.

a distinct species, and taxonomists have not been unanimous in accepting Correll's treatment.

Variety *ochroleuca* (Rydb.) Ames is poorly understood, and there has been much uncertainty concerning its status. It may be distinguished by its yellowish, strongly fragrant flowers and long floral bracts, the lower ones of which exceed the flowers in length. It is said to produce monoembryonic seeds, in contrast to the polyembryony characteristic of typical *S. cernua*. Its distribution has been variously restricted to east of the Appalachians or expanded to include the entire range of the species.

Other species and varieties have been proposed in this complex, but all have been referable, at least in the absence of a thorough study of possible ecotypic differentiation in this species, to the var. *cernua* complex, to var. *odorata*, or to other species.

It is thus only with caution that one would describe a new taxon in this complex, for the danger of introducing additional confusion is great. However, if progress is to be made in our understanding of the group, some risk must be taken, and, in the hope that it will aid in a clarification of the situation, I am describing the following species. My understanding of this species and the *S. cernua* complex as a whole is based on fourteen years of field experience principally in Illinois and surrounding areas and on the study of hundreds of herbarium specimens from all parts of the range of the complex. During this period, the habitats of the complex were studied in detail, and three habitat groups emerged. Further study revealed that morphologically distinct populations were restricted to the various habitats, thus indicating the presence of taxonomic differentiation within the complex. Two of the three evident taxa are here considered to be ecotypes of *S. cernua*. The third, however, has proven distinct enough to warrant specific rank.

Spiranthes magnicamporum *Sheviak spec. nov.*

Herba erecta, infra glabra, supra pubescens, copiosa cum trichomis capitatis, 15–57 cm. alta. Radices tuberoso-crassae, usque ad 8 mm. in diametro. Folia omnia radicalia, fugacia, lineari-lanceolata, basi cuneata, acuta, usque ad 12 mm. lata, 14 cm. longa. Caulis gracilis ad lacuno-crassa, 1.5–7 mm. in diametro, aliquot bracteis vaginantibus instructa. Spica densa, 15–28 mm. in diametro, 4–18 cm. longa. Phyllotaxis $\frac{1}{3}$ vel rariter $\frac{1}{4}$; orthostichies saepe in forma spirale. Bracteae floriferes ovatae, attenuatae vel saepe acuminatae, 10–30 mm. longae. Flores albi ad eborei, labelli pars centralis saepe flava, valde cumarino-aromatici; segmentis perianthii extus pubescentibus. Sepalum dorsale lanceolatum, acutum, 7–11 mm. longum, 1.5–3 mm. latum; sepala lateralia libera, late patentia ad rariter laxe incurvata, lineari-lanceolata ad lineari-oblonga, acuminata ad obtusa, 7–11 mm. longa, 1–2 mm. lata. Petala sepalo dorsale adhaerentia, linearia, acuminata, 7–10 mm. longa, fere 1 mm. lata. Labellum oblongo-ovatum ad rhombico-ovatum vel rariter fere triangulare, potius aequaliter arcuatum sed apice saepe abrupte reflexum: sine dilatatione basale vel constrictione mediane; margine integro vel parte quarta apicole dentato, vix crispo; 7–11 mm. longum, 3.5–6 mm. latum; calli basales prominentes, pubescentes.

Typus: *R. A. Evers* 98153. "Hill prairie, 3.5 mi., S., of Eldred, Greene Co., Illinois, Oct. 10, 1968." (specimen "a"). *Typus in* ILLS.

Other characteristic, noteworthy collections include:

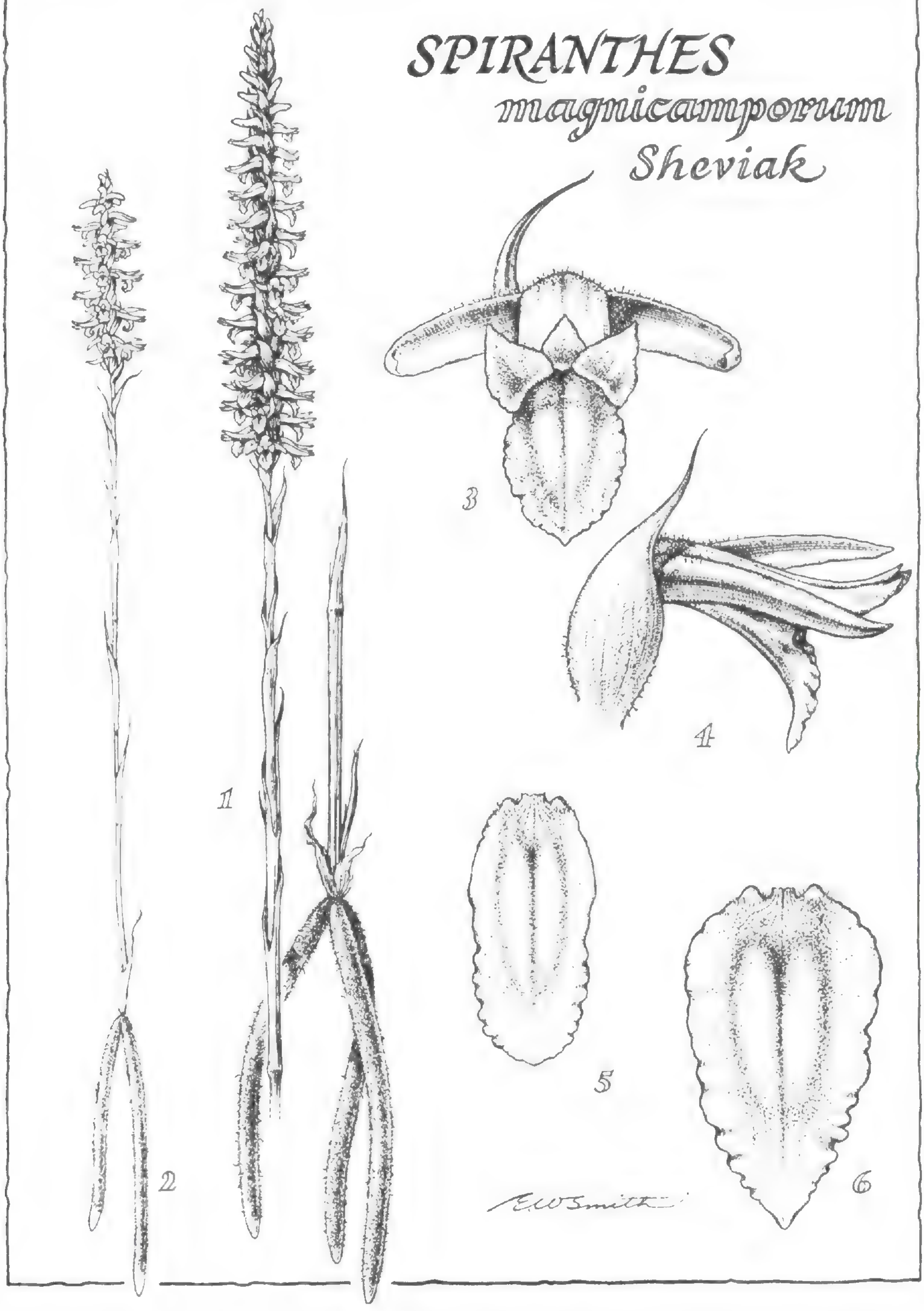
R. T. Rexroat 4411. "Oct. 2, 1957. Scott Co., Illinois. High loess hillside. Fls. very fragrant." (ISM).

C. J. Sheviak 352. "Orchidaceae of Illinois: 69-11-07-04: very abundant in grazed hill prairie. with *An-*

dropogon scoparius, *Linum sulcatum*, *Aster azureus*, *Petalostemum purpureum*." full sun. soil dry calcareous loess. Bland Hill Prairie, 3.2 miles N. of Eldred, Greene County. 7 November 1969." (To be deposited at ILL.)

Spiranthes magnicamporum occurs on dry prairies and related grasslands from northwestern Indiana onto the Great Plains (hence the specific epithet "*magnicamporum*", a direct translation of "of the Great Plains") with disjunct populations on the prairies of western Ohio and the black belt of Mississippi and Alabama. It ranges from Texas north to at least North Dakota.

Spiranthes magnicamporum differs from *S. cernua* var. *cernua* in several characters. The flowers of well developed plants of *S. magnicamporum* are larger than those of var. *cernua*, the perianth often exceeding 1 cm. in length. The lip of *S. magnicamporum* is uniformly oblong-ovate to rhombic-ovate, characteristically without the dilated base usually present in var. *cernua*. In var. *cernua*, the apical portion of the lip is also occasionally dilated, thus producing a lip with a median constriction. These dilations are nearly always absent in typical *S. magnicamporum*. The central portion of the lip of typical *S. magnicamporum* always supports a prominent thickening that is distinct even in boiled herbarium material. This is a variable character in *S. cernua* and is often absent. Crisping of the lip is less marked in *S. magnicamporum* than in var. *cernua*, and the laceration of the lip is suppressed, the margin often quite entire or the apical quarter merely dentate. Lateral sepals are free and widely spreading to rarely loosely incurved or often ascending, unlike those of var. *cernua*, which closely parallel the petals and join to form a hood. The flowers of *S. magnicamporum* are often more nearly cream-colored than the white usual in var. *cernua*, and the central thicken-



Spiranthes magnicamporum Sheviak. 1 and 2, plants, one half natural size. 3, flower and tip of bract, front view, three times natural size. 4, flower and bract, side view, three times natural size. 5 and 6, lips, somewhat flattened, four times natural size. *Drawn by* ELMER W. SMITH

ing of the lip is often yellow. They are strongly fragrant with the scent of coumarin, in contrast to the flowers of var. *cernua*, which, in the geographical zone of contact in the midwest, at least, are generally scentless, or, when aromatic, exhibit usually but a faint fragrance strikingly like the scent of fresh *Cypripedium* roots. In well developed specimens of the two taxa, the inflorescences are strikingly different due to differences in the orientation and shape of the flowers. The nodding of var. *cernua* is accentuated by a general curvature of the dorsal sepal, whereas in *S. magnicamporum* this segment is arcuate only near the base. The orientation of the lip also varies: in *S. magnicamporum* it is rather uniformly arcuate along its length, although the apex is often abruptly reflexed, whereas in var. *cernua* the lip is often rather geniculate at about the middle. These differences in flower shape and orientation lend different aspects to their respective inflorescences. In var. *cernua*, the general impression is of an ornate inflorescence, an impression often accentuated by the reflexed tips of the sepals and petals. In *S. magnicamporum*, the more linearly organized flowers produce a strikingly scalariform inflorescence. The populations of typical *S. magnicamporum* which I have studied produce monoembryonic seeds, although polyembryony appears to be frequent in some areas. The seeds of this species tend to be short and broad, generally oblong-quadrate and truncate but occasionally vary toward the more fusiform seeds of var. *cernua*. The living plants of typical *S. magnicamporum* available for study were not apogamous, whereas I have found that var. *cernua* characteristically sets seed without pollination.

These taxa vary vegetatively as well. A salient feature of *S. magnicamporum* is the absence of leaves at anthesis. these senesce two to several weeks before the inflorescence appears. In var. *cernua*, however, they persist dur-

ing anthesis or, under adverse conditions, senesce as the inflorescence develops. This behavior is genetically determined and cannot be altered under cultivation. The roots of *S. magnicamporum* also tend to differ from those of *S. cernua* in their greater tuberosity (the smaller plant illustrated in the figure possessed abnormally slender roots).

Many of these characters vary with the vigor of the plant and are sometimes difficult to utilize in depauperate or stunted individuals. It is of great significance that cultivation increases the expression of typical characteristics of the two species, even in specimens of previously obscure relationships. Under more nearly uniform cultural conditions, many previously similar individuals of the two species diverge greatly in phenotype, thus supporting the separation here proposed, but further indicating the difficulty inherent with the group.

What is here described as *Spiranthes magnicamporum* has also been confused with var. *ochroleuca* and var. *odorata*. It is not referable to var. *ochroleuca*, as the original description of *Gyrostachys ochroleuca* (the type specimen cannot be located) refers to "lower stem leaves" which do not occur in *S. magnicamporum*. The flowers of var. *ochroleuca* are also evidently smaller than those typical of *S. magnicamporum*. Furthermore, *S. magnicamporum* is a distinctly western species and apparently does not occur east of western Ohio, where it is disjunct. The type of var. *ochroleuca*, however, was collected in New England.

Unfortunately, I have not seen var. *odorata* in the field and do not have a satisfactory understanding of it. *Spiranthes magnicamporum*, however, appears to be closely allied to it and may represent a northwestern, dry, exposed-site counterpart. The aspect of the inflorescences and some floral details of both of these taxa are notably similar. They differ in persistence and location

of leaves and in the nature of the roots. Both of these characters are genetically determined in *S. magnicamporum*, and development under wet conditions does not alter them. Even in two specimens from calcareous hanging fens in Illinois the leaves remained fugacious and the roots tuberous.

In general, it appears that *S. magnicamporum* is a western, prairie counterpart of *S. cernua*. Although not allopatric (indeed, *S. cernua* occurs further west than *S. magnicamporum* in several areas), *S. magnicamporum* is the more prevalent in the west and is better adapted to the droughty conditions of the area than is *S. cernua*, which often relies upon local abundance of moisture for its survival.

The two species, are, however, truly sympatric only on rare occasions, for even where occurring at the same station these species are spatially isolated by ecological factors. Of the two ecotypes of var. *cernua* that I have been able to distinguish in the Illinois region, one occurring principally in moist sand prairie, the other in dry open woods and old fields on finer textured soils, usually only the former occurs with *S. magnicamporum*. At such stations *S. magnicamporum* occupies the dry ridge tops and *S. cernua* the wetter swales. Both of these taxa occur in calcareous hanging fens, but *S. magnicamporum* does so very rarely, only two such stations being known, and I have never seen them associated at such a site. *Spiranthes magnicamporum* is further isolated from this sand prairie ecotype of *S. cernua*, at least in the southern Lake Michigan region, by season, as these *S. cernua* populations bloom from mid-August to mid-September, whereas in *S. magnicamporum* anthesis is initiated usually in mid-September and continues into October. Floral fragrance (which is lacking in this ecotype of *S. cernua*) may likewise serve to isolate these taxa.

Spiranthes magnicamporum is also apparently isolated from the old field-open woodland ecotype of *S. cernua* by edaphic factors. In my experience, *S. magnicamporum* has proven to be a distinct calciphile, whereas the old field ecotype of *S. cernua* occupies strictly acidic soils. Only two specimens of *S. magnicamporum* are known from areas of generally acidic soils, but the precise natures of these stations are unknown. Both could be from localized calcareous areas which occur in the regions involved. Floral fragrance probably further isolates these taxa. Pollination studies (which were not possible during my study) would be most useful in this group.

These two ecotypes of *S. cernua* have also proven to be genetically isolated from *S. magnicamporum*, at least in the small sample available for study. Four plants of *S. magnicamporum* from two localities in Illinois (Greene and Lake counties) were crossed with three plants of *S. cernua*, two of the old field ecotype from two localities (Pope County, Illinois and Fountain County, Indiana) and one of the sand prairie ecotype (Kankakee County, Illinois). A total of twenty crosses were made using *S. magnicamporum* as the pistillate parent (because of the apogamous nature of *S. cernua*) and flowers of several ages. Absolutely no seed was obtained from these crosses. It should be noted, however, that because of differences in period of anthesis, the pollen from the sand prairie ecotype of *S. cernua* was stored for two weeks before use.

It is clear that this apparent isolation does, in fact, occur. It is indicated by the situation in a region of dune and swale topography along the Lake Michigan shore in Lake County, Illinois. Here *S. cernua* (sand prairie ecotype) occurs by the hundreds in low sand prairie swales. Infrequent plants of *S. magnicamporum* are scattered on the xeric ridges. I have never found an intermediate plant in the field, despite intensive search, and

have seen only one or two preserved specimens from this locality that showed signs of intergradation.

Apparently, the differences in edaphic requirements of *S. magnicamporum* and the old field ecotype of *S. cernua* normally preclude their close association, but I have recently learned of a station that supports both taxa. The small number of specimens that I have seen from this locality do not allow definitive work, but it seems that the two species are maintaining their integrities at the site. The edaphic nature of the area that allows such an admixture is unfortunately unknown.

Because of the several apparent isolating mechanisms present between *S. cernua* and *S. magnicamporum* and the evidently greatly restricted gene exchange, I consider them to be distinct species.

Nevertheless, it is apparent that some gene exchange has occurred. Particularly in sand deposits, intermediate specimens may occasionally be found. In nearly all such cases of which I am aware, however, such plants are from disturbed sites; drainage, intensive pasturage, and excavation are common factors in Illinois. Fewer intermediates are found in areas where the *S. cernua* influence must have been contributed by the old field ecotype, and only limited introgression is indicated.

One major intermediate race is known, however, and it complicates the situation. In northern Illinois, there occur, in low black-soil prairie, populations somewhat intermediate between *S. magnicamporum* and the sand prairie *S. cernua*. It appears that rare crosses between these taxa have produced a race that occupies a hybrid habitat. This race differs from typical *S. magnicamporum* in the presence of a basal dilation of the lip and the poor development or even complete absence of the central thickening. I have seen only two live plants of this taxon in bloom, and these were apogamous. Although scented

as in typical *S. magnicamporum*, the intensity of fragrance was less than in typical plants of this species. Specimens of this race are, however, still recognizable as *S. magnicamporum* by the aspect of the inflorescence, the position of the lateral sepals, floral fragrance, the fugacious nature of the leaves, and the tuberosity of the roots.

These plants occupy low calcareous black-soil prairie. They may occur over but a restricted portion of the range of *S. magnicamporum*, and I have recognized them only in northern Illinois. Judging from the numbers of specimens and known stations, this taxon seems to be particularly well represented in the Chicago area, although this observation may reflect irregularities in collecting activity.

It is apparent that these plants are intermediate between *S. cernua* and *S. magnicamporum*. Thus, this race may have arisen as a hybrid between *S. magnicamporum* and the sand prairie *S. cernua*. Evidently a portion of the resulting offspring became established in the edaphically hybrid habitat of low black-soil prairie. The presence of this race outside the range of the sand prairie *S. cernua* in Illinois suggests that this hybrid taxon spread from its point of origin to its present range across northern Illinois. It would appear most likely that the initial hybridization occurred in the Chicago area, where the greatest concentration of populations are to be found and where the necessary juxtaposition of the parents and low black-soil prairie occurs.

It is not clear if a single or several hybridizations were involved in the founding of these populations: indeed, it is possible that similar populations have arisen independently at other localities in the range of *S. magnicamporum*. Nor is the influence of backcrossing known. Variation between the parents occurs, but it is not known if this reflects segregation from a single initial hybrid

gene pool or repeated hybridization. The point is of significance to this work because it affects the taxonomic status of these populations. Because backcrossing is more likely between these plants and *S. magnicamporum* than between them and the usually spatially isolated *S. cernua*, and because the two live plants that I have seen and the majority of herbarium specimens examined appear more characteristic of *S. magnicamporum* than *S. cernua*, in the absence of wider experience with these plants it seems best to treat them as a vaguely defined race of *S. magnicamporum* rather than to consider them in a more definitive manner.

That such hybridization can occur is of interest in addition to its relevance to the problems inherent in determining a specimen in this complex. I have seen a few specimens from east of the range of *S. magnicamporum* that exhibited various characters of this species but which were otherwise referable to *S. cernua*. Occasionally these were collected with normal specimens of the latter species. It would appear that during the xerothermic period *S. magnicamporum* ranged much further east than at present, following the availability of dry prairie. As the climate moderated, this species retreated westward, but some hybridization with *S. cernua* did occur as environmental barriers deteriorated. Genes of *S. magnicamporum* were then thoroughly incorporated in the gene pools of various populations of *S. cernua*, so that now recombination produces rare plants suggesting *S. magnicamporum* in various respects.

It is unfortunately not certain how *S. magnicamporum* behaves with regard to var. *odorata*. I have not had live material of this taxon available for hybridization experiments. Apparently the only contact between the ranges of these taxa is in the black belt. They cannot, however, be truly sympatric because of their different habitat re-

quirements. Furthermore, it is almost inconceivable that they could produce hybrid offspring capable of finding suitable habitat for survival even if they were associated somewhat closely. Indeed, the fact that these two taxa remain distinct in this area supports their taxonomic separation.

It should be noted that, although this work represents only a beginning of our understanding of the *S. cernua* complex, it does open an interesting possibility. Much, if not all, of the material from the North and West that has been referred to var. *odorata* is in actuality *S. magnicamporum* or introgressed *S. cernua*. This situation suggests that a re-evaluation of var. *odorata* is in order and may further clarify the status of this and other segregates of the *S. cernua* complex.

Acknowledgments

I would like to express my appreciation to the curators of the many herbaria that lent specimens for this study. I am particularly indebted to Dr. Robert A. Evers for sharing his knowledge of the loess-bluff hill prairie ecology of *Spiranthes magnicamporum*, and for accompanying me to several stations of his discovery, including that which was later to be designated the type locality. I also wish to thank Dr. Alan Haney and Dr. Leslie Garay for valuable discussions, and Dr. Richard E. Schultes for assistance with the Latin description.

STUDIES IN AMERICAN ORCHIDS IX

BY
LESLIE A. GARAY

The following nomenclatorial observations have been accumulated over the past few years in connection with research carried out at the Orchid Herbarium of Oakes Ames, resulting mostly from requests for identifications. Number VIII of this series was published in Bradea 1: 301–308, 1973.

Scaphyglottis minuta (*Rich. & Gal.*) *Garay comb. nov.*

Basionym: *Polystachya minuta* Rich. & Gal. in Ann. Sci. Nat. ser. 3, 3: 27, 1845.

Syn.: *Hexadesmia confusa* Schltr. in Fedde Rep. 10: 361, 1912.

Pachystele confusa (Schltr.) Schltr. in Fedde Rep. Beih. 19: 114, 1923.

Scaphyglottis confusa (Schltr.) Ames & Correll in Bot. Mus. Leafl. Harv. Univ. 10: 85, 1942.

An examination of Richard's drawing of *Polystachya minuta* preserved in the Paris herbarium convinces me that it is referable to the genus *Scaphyglottis*; its details are identical with the original drawings of *Hexadesmia confusa*, now preserved in the Orchid Herbarium of Oakes Ames.

A careful re-evaluation of the Ponera alliance may

prove Schlechter correct for establishing a separate genus —*Pachystele*—for the plants referable to this species.

Neokoehleria corydaloides (*Krzl.*) *Garay comb. nov.*

Basionym: *Rodriguezia corydaloides* Krzl. in Fedde Rep. 25: 24, 1928.

Syn.: *Scelochilus corydaloides* (Krzl.) Garay in Bot. Mus. Leafl. Harv. Univ. 18: 208, 1958.

A re-examination of the type, Buchtien no. 528!, convinces me that this species is a member of the genus *Neokoehleria* rather than the genus *Scelochilus*. In floral details it is apparently related to *N. equitans* Schltr., but the plants have no equitant leaves. *Neokoehleria Rauhii* Senghas is also an allied species.

Rusbyella caespitosa *Rolfe* in Mem. Torr. Bot. Club 6: 122, 1896.

Syn.: *Odontoglossum pusillum* C. Schweinf. in Amer. Orch. Soc. Bull. 14: 340, 1946.

An examination of the holotype of both *Rusbyella caespitosa* and *Odontoglossum pusillum* has shown them to be conspecific. The cruciform arrangement of the sepals and petals resembles the pattern found in the flowers of *Mesospinidium;* the shape of the lip is analagous to *Solenidium;* the structure of the column approaches that of *Rodrigueziella* (*Theodorea*).

Oncidium guianense (*Aubl.*) *Garay comb. nov.*

Basionym: *Ophrys guianensis* Aubl., Hist. Pl. Guiana Fr. 2: 86, 1775, based on "*Helleborine foliis carnosis, carinatis & falcatis*", Plum. Cat. 9, 1703 and Pl. Amer. ed. Burmann, fasc. 8: t. 182, f. 2, 1759.

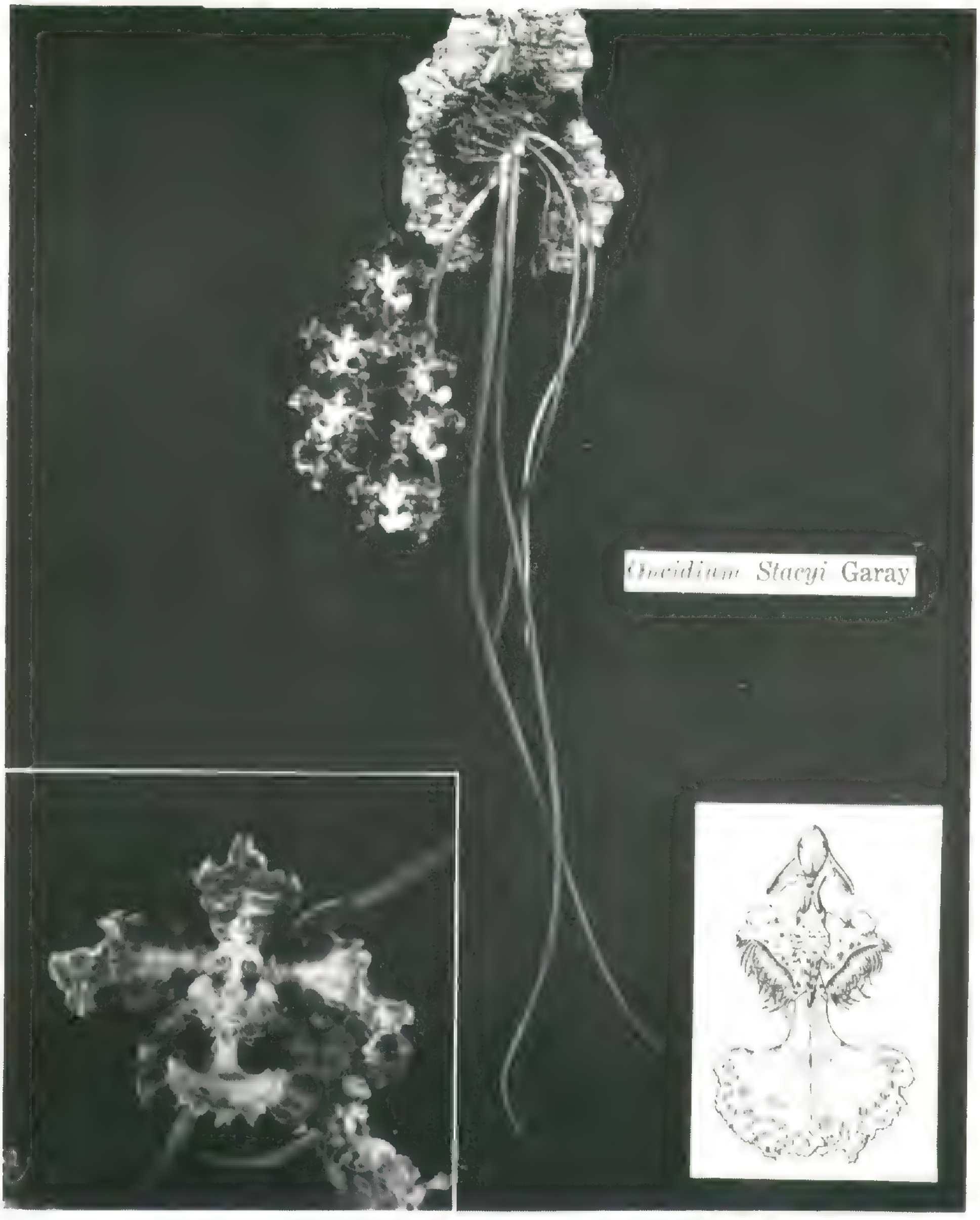
Syn.: *Ophrys aloidea* Poir. in Lam. Encycl. 4: 569, 1798.
Oncidium desertorum Nash ex Withner in Amer. Orch. Soc. Bull. 36: 312, 1967.

When Dr. Withner described *Oncidium desertorum*, he designated the copy of the Plumier plate cited above and kept in our collection as being referable to his species. Unfortunately, it has been overlooked until now that this very plate has already been given twice a new name. The specific name is quite inappropriate today, but in the 18th century the French possessions in the West Indies were also called the Guianas.

Oncidium Stacyi *Garay sp. nov.*

Epiphytica, caespitosa, pendens; radicibus satis crassis, flexuosis, glabris; pseudobulbis approximatis, vix ullis, cylindraceis, monophyllis; foliis teretibus, valde elongatis pendulis, usque ad 70 cm. longis, 0.8 cm. crassis; inflorescentiis pendulis, laxe plurifloris, usque ad 30 cm. longis; pedunculo tereti, distante paucivaginato, usque ad 15 cm. longo; rhachide fractiflexo; bracteis ovato-lanceolatis, acuminatis, quam ovariis pedicellatis plus duplo brevioribus, usque ad 12 mm. longis; floribus conspicuis, pulcherrimis; sepalis flavescentibus, brunneo maculatis, labello aurantiaco, brunneo picto; sepalo postico late elliptico vel obovato-elliptico, obtuso, margine undulato, usque ad 27 mm. longo, 17 mm. lato; sepalis lateralibus e cuneata basi oblique ellipticis, quasi subfalcatis, obtusis, margine undulatis, usque ad 27 mm. longis, 10 mm. latis; petalis ellipticis, apice subtruncatis, margine undulatis, usque ad 30 mm. longis, 16 mm. latis; labello e basi late obcuneata supra medium valde constricto, quasi pandurato, antice in laminam subreniformem, excisam dilatato, margine utrinque supra isthmum

PLATE XXIII



longe fimbriato, ceterum eroso-denticulato, disco basin callo trapezoideo, denticulato, cum callo 3-lobo anteposito ornato; toto labello excepto callo minutissimime puberulo, 25 mm. longo, antice 20 mm. lato; columna humili, satis crassa, alis falcato-triangularibus ornata; ovario pedicellato usque ad 3 cm. longo.

Bolivia: Naranjillos, road to Cochabamba, 11 km. southwest from Santa Cruz. Coll. J. Stacy s.n.! Type (AMES).

This new species is somewhat allied to *O. Jonesianum* Rchb.f. of the Section *Teretifoliae* but differs from it in having larger flowers, different coloration and a very lacerate lip. As a matter of fact, the lacerate margin of the basal part of the lip is a unique feature in the section.

With much pleasure I dedicate this new species to the collector, Mr. John Stacy, a dedicated orchidophile and a distinguished friend of the Orchid Herbarium of Oakes Ames.

Anthosiphon pseudobulbosus (*C. Schweinf.*) *Garay comb. nov.*

Basionym: *Cryptocentrum pseudobulbosum* C. Schweinf. in Bot. Mus. Leafl. Harv. Univ. 12: 189, 1946.

The presence of a pseudobulb and the connate sepals forming a tube are the characters of the genus *Anthosiphon*. Although Mr. Hawkes reduced *Anthosiphon* to sectional status under *Cryptocentrum*, the reduction is quite unjustified. The apparent similarity in the floral structures found in the plants of both genera are the result of convergent evolution rather than intrageneric differentiation. As a matter of fact, *Scpalosiphon* of New Guinea is another example of convergence between *Cryptocentrum* and that genus.

Pterostemma frigidum (*Dodson & Dressler*) *Garay comb. nov.*

Basionym: *Cypholoron frigida* Dodson & Dressler in Phytologia 24: 285, 1972.

The characters of the recently published *Cypholoron* are entirely those of *Pterostemma*, hence the above transfer is necessary.

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THE ROLE OF 'FLOWERS' IN NAHUATL CULTURE: A SUGGESTED INTERPRETATION

BY

R. GORDON WASSON

In the course of editing the text of a midnight mushroom *velada* ('vigil') sung by María Sabina, the Mazatec *curandera* or shaman, I have had occasion to concentrate my attention on the famous statue of Xochipilli, in the Museo Nacional de Antropología in Mexico City, with results that I would now submit to students of the Mesoamerican cultures.

Xochinanácatl. All students of the history of Nahuatl culture are familiar by now with the word *teonanácatl*, 'god's flesh', the name used for the hallucinogenic mushrooms by Fray Bernardino de Sahagún and Fray Toribio de Benavente called Motolinía. But we may be justified in asking ourselves why this term is not to be found in Fray Alonso de Molina's great lexicon of the Nahuatl language published in 1571. He gives us another word, *xochinanácatl*, 'flower mushroom', from *xochitl*, 'flower'.

We find *xochinanácatl* in a place name that survives to this day, Xochinanacatlán, a *municipio* of Tlaola, district of Huachinango, State of Puebla. Does the word occur anywhere else in Nahuatl texts? Was it one of perhaps several alternative expressions for the psychotropic mushrooms, one that Alonso Molina may have

had good reason to give to his readers rather than *teonanácatl*, 'god's flesh', an appalling word for a 16th Century churchman to write down, to utter, or even to think? As the mushrooms carried with them an aura of holiness for the Indians, it was certainly inevitable that there should be a variety of evasive terms for them.

A peculiar trait of Nahuatl poetry is the preoccupation of the poets with 'flowers': they write incessantly about flowers but they fail to distinguish the kinds of blossoms, though Nahuatl was rich in botanical terminology. This feature of Nahuatl poetry has baffled students: it seems inconsistent with the nature of poets, who delight in fine distinctions. It has even been called to the attention of the outside world. In *The Times* (London) of 15 May 1961 there appeared a dispatch from Mexico City written by their correspondent stressing this odd fact: 'Strangely, the ancient Mexican poet seldom differentiated between one blossom and another, although old indigenous names for many plants exist.' If *xochitl* was used by the poets as a metaphor for the inebriating mushrooms, or for hallucinogens as a class, this would explain the poets' addiction to the generic term for all flowers.

Here are examples where I think *xochitl* stands for the inebriating mushrooms:

1. O ya noconic in nanacaoctli ya noyol in choca. . .
   ma yuh tonpolihuiz a iz ca to*xochiuh*.
   ¡Ay, he bebido licor de hongos embriagadores: mi corazón llora!. . .
   ¡así has de desaparecer! ¡Aquí están tus *flores!*

   O! I have drunk the liquor of inebriating mushrooms! My heart is weeping!. . .
   Thus you are to disappear! Here are your *flowers!*

   Romances de los Señores de la Nueva España, c. A.D. 1470, Ms. in the Library of the University of Texas, Austin. Published in *Xochimapictli*, ed. by Father Garibay, Mexico, 1959.

2. Xoxopan, yn ompa temoaya in Ipalnemohuani, in mocuicaizhuayotia, moxochiapana.
Huehuetitlan momalina, ye motech onquiza an *yhuinti xochitli*. ¡Ma xonahuiacan!
En el verano, cuando desciende el Dador de la Vida, todo reverdece con sus cantos, se adorna con sus flores. En el lugar de los atabales, de tí salen *las flores que embriagan*. ¡Alegráos!
In summer, when the Giver of Life descends, everything turns green with his songs, is adorned with his flowers. In the place of the kettle drums, from You spring forth *the flowers that inebriate*. Rejoice!

Same collection of *Romances*, see above, but not published in *Xochimapictli*.

3. Ica xon ahuiacan *ihuinti xochitli* tomac mani: Ma on te ya-quilo toxochicozqui in toquippanxochiuh.
Tla cecelia *xochitli*, cueponia *xochitli*. Onean nemi tototl chachalaca tlatohua. Ohua yahualo quiman teotl ichan.
Gozáos con las flores que son embriagadoras: están en nuestras manos. Que sean introducidos nuestros flores de tiempo de lluvia. ¡Estén rozagantes las flores, abran sus corolas las flores! Anda por ahí el ave, parlotea, gorjea. Con pena da giros: ¡va en pos de la casa del dios!

Enjoy the inebriating flowers! *Bring on our necklaces of flowers! Our flowers of the rainy season!* May the flowers be showy, may the flowers unfold their corollas! There goes the bird, chattering, gurgling. With difficulty he darts around. He goes in quest of the house of god!

Same collection of *Romances*, see above.

[Italics mine.]

Note: What Father Garibay translated as *corola* ('corolla'), could it be the pileus of *xochinanácatl*?

Xochipilli. Let us assume that this interpretation of *xochitl* as an alternative name for the sacred mushrooms holds good. In that case we should turn to Xochipilli, a divinity in the Aztec pantheon, the 'Prince of Flowers' as Miguel León Portilla has translated his name, and specifically to the powerful statue that represents him, a statue unearthed in Tlalmanalco on the slopes of Popocatapetl, now on display in the great hall of the Museo Nacional in Mexico City. (See Plate XXIV.) Justino Fernández has given us a detailed description and explanation of this statue in 'Una aproximación a Xochipilli' in *Estudios de la Cultura Nahuatl*, Vol. 1. I will now submit for consideration an utterly different interpretation of it.

Justino Fernández cannot help but see the 'ecstasy' (this is his word) in the expression on this man's face, but for his explanation ecstasy is superfluous, perhaps even out of place, and he would minimize this trance-like pose for the original viewers by suggesting that if the eye-sockets were filled with precious materials, as he thinks they once were, this impression would be reduced.

For me ecstasy in this statue is of the essence. The skyward tilt of the head, the half-open mouth and jutting jaw, the hands poised in the air at different levels,[1] the crossed legs and feet raised off the ground: here is the work of a master, a supreme carving of a man enjoying an unearthly experience, the formal, hieratic effigy of the God of 'Flowers', of the God of Rapture.

If one looks into the eye-sockets or even more clearly under the chin, one observes that this man is wearing a mask. In the cultures of the West the mask has no longer importance: it is relegated to children or to light hearted entertainment, as in masked balls and the fes-

[1] Here there is a puzzling factor: in the palm of the left hand and in the middle of the chest there are indications of something missing, broken. What was this lost object?

Plate XXIV

Xochipilli, 'Prince of Flowers'
Statue on exhibit in Museo Nacional de Antropologia, Mexico City.
Photo from Archive of Inst. Nac. de Antrop. e Hist.

tivities that welcome in the New Year. But in antiquity and in virtually all the other cultures of the world the mask takes on serious purport. It shows the salient trait of character that the bearer means to portray, a personification of that trait. In the Xochipilli statue obviously the mask dramatically emphasizes the ecstatic man, and does so with the power of genius. Here is a man who is not seeing, not living as ordinary mortals see and live, who is seeing directly with the eyes of the soul. This man is not with us, is in a far off world. (See Plate XXVIII.)

I like to think that the eye-sockets were empty from the beginning, intentionally so. In this hieratic carving with mask and formal head dress, we are given the opportunity to perceive to the full the role played by rapture in pre-Columbian Mesoamerican culture, the gravity with which the hallucinogenic experience was instinct.

Let us now examine the bas-reliefs that adorn the body of the man and the base on which he rests. And here we come on surprising facts. As I am no botanist, I invoked the help of Professor Richard Evans Schultes, Director of the Botanical Museum of Harvard University, and the following identifications largely reflect his thinking and that of his students, Mr. Timothy Plowman and Mr. Tommie Lockwood and his colleague, the scientific artist Mr. Elmer W. Smith. Certainly many of the carvings, and probably all, are of hallucinogenic plants familiar to the Aztecs, and thus they clinch my initial response to the pose of the statue. So that the reader may judge the identifications, the distinguished artist Margaret Seeler has drawn the series of figures that we now show in our text.

The base and the man are separate stones but clearly they were made for each other. The carvings are stylized in varying degree and one or two of them seem to be but roughly finished. Let us begin with the base.

The same conspicuous emblem, obviously a plant motif, is repeated on the four sides of the base and many have referred to it as a 'flower'. But what flower and why? From the beginning I thought that the five convex devices with inturned margins arranged in a circle were mushrooms. They are the caps in profile. A sixth is hidden by the carving of a mythic butterfly. But the caps of mushrooms offer us a wide variety of shapes, in the wide variety of species and in the different stages of the life cycle of each species. Even among the hallucinogenic kinds—species of Psilocybe, Stropharia, and Conocybe—there is much diversity. The slopes of Popocatapetl are the land of Tlalocan, the paradise of the Nahua, and here the statue was unearthed, in the heart of the sacred mushroom country. It was precisely in this vicinity that Professor Roger Heim discovered with the help of Nahuatl-speaking Indians *Psilocybe aztecorum* Heim, a species then new to science, described and illustrated later in *Les Champignons Hallucinogènes du Mexique*,[2] Plate XV, with the description on pp. 154 158. I draw attention to his figures 15 and 16 of specimens found in their natural habitat and showing the pileus at the moment when it begins to break forth into maturity. Slightly stylized, the mushrooms in stone catch admirably the precise convex shape of the actual pileus or cap of the living plant. The inturned margins (*la marge. . . incurvèe*, as Professor Heim says) are one of the specific characteristics distinguishing this species of Psilocybe. The left-hand Figure 1a reproduces what we find on the statue and 1b the illustration in *Les Champignons Hallacinogènes:*

[2] By Roger Heim and R. G. Wasson, published in 1958 by the Muséum National d'Histoire Naturelle in Paris.

a Fig. 1 b

Profile of *P. aztecorum* compared with Xochipilli base.

The mushroom at this stage in its life is scarcely two centimeters at its greatest width. The mushroom motif also appears repeatedly on the body of our man in rapture—on both his knees, on his right forearm, on the top of his elaborate headdress. In these body representations the mushrooms are reduced to three in number, but always with the same profile. Both on the base and more conspicuously on the body there seem to be other mushrooms behind the ones that we have discussed, only the peak of the cap of these other mushrooms being visible:

Fig. 2

On the base there is what everyone familiar with Mesoamerican art will recognize as a highly stylized

Plate XXV

View of Xochipilli, right side.

butterfly, perched among the mushrooms and concealing the sixth one, apparently feeding on them. Why the butterfly? In this world of nature mushrooms do not draw butterflies, but in the iconography of the Nahua and Mixtecs butterflies play an important mythic role, as we see in the butterflies of the famous mural of Tepantitla, showing us Tlalocan, the paradise of the Nahua. Butterflies are associated with the land of fortunate departed spirits. George Cowan in *Yan* (1953 No. 2) has told us that in some parts of the contemporary Mazatec world butterflies are still considered to be the souls of the departed revisiting their native haunts. On the base of the statue of Xochipilli the butterfly is feasting on the flesh of the divine mushrooms, the spirit food of the gods, to whose world the mushrooms transport for a brief spell the people of this sad work-a-day world. Mrs. Seeler has reproduced this mythic butterfly, the symbol that certainly supports and ratifies our identification of the sacred mushrooms:

Fig. 3
The Mythic Butterfly

On three sides of the base there are groups of four concentric circles, one group on each side of what we have suggested are the sacred mushrooms, *Psilocybe aztecorum*. On the back of the elaborate hairdress there are five such groups, balanced in four cases with four rods. According to orthodox interpretation these are numbers, each of the rods being 5, that is, 20 to every group of 4, and each group of circles being 4. We can suggest no explanation of these ostensible numbers. There is a wavy line running around the base near its top edge and the suggestion has been made that it signifies water. Along the upper edge of the base we find a row of concentric circles, the glyph that also means 'water', a glyph, as we hope to demonstrate in a future paper, that grew out of the glyph for 'mushroom' in Teotihuacan III.

On a pectoral or breastplate that Xochipilli is wearing there may be two carved 'mushrooms', but I am in some doubt about them. The earrings that the statue wears could be mushrooms, but these concentric circles might easily be something else. So much for the sacred mushrooms.

Let us now turn our attention to *Rivea corymbosa*, the *ololiuhqui* of the Nahua, the hallucinogenic morning glory identified with Mesoamerican cultures. On the right thigh near the knee there is a carving of the morning glory flower as one views it looking into the cup. Mrs. Seeler reproduces the carving on the thigh and also copies the illustration of *Rivea corymbosa* from the same angle as shown in Schultes' classic paper, 'A Contribution to Our Knowledge of *Rivea corymbosa*, the Narcotic Ololiuqui of the Aztecs', published by the Botanical Museum of Harvard University in 1941. (Fig. 4, p. 316.)

On the left leg below the knee and again just above the knee on the left thigh there are carvings of the

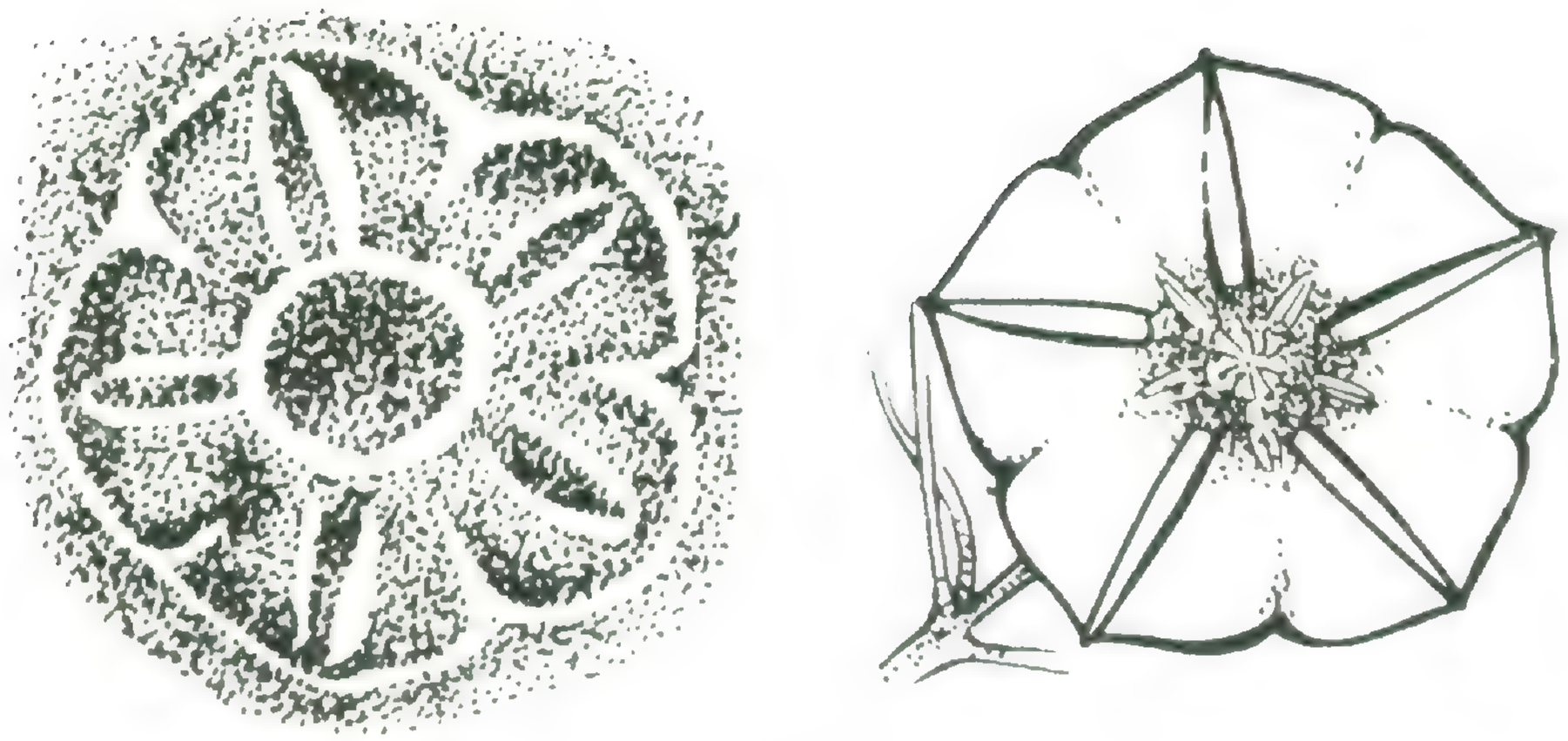


Fig. 4
Rivea corymbosa or *ololiuhqui*

emerging morning glory flower, showing the plaiting and convolutions characteristic of that stage. In Fig. 5 Mrs. Seeler reproduces the design on the left thigh:

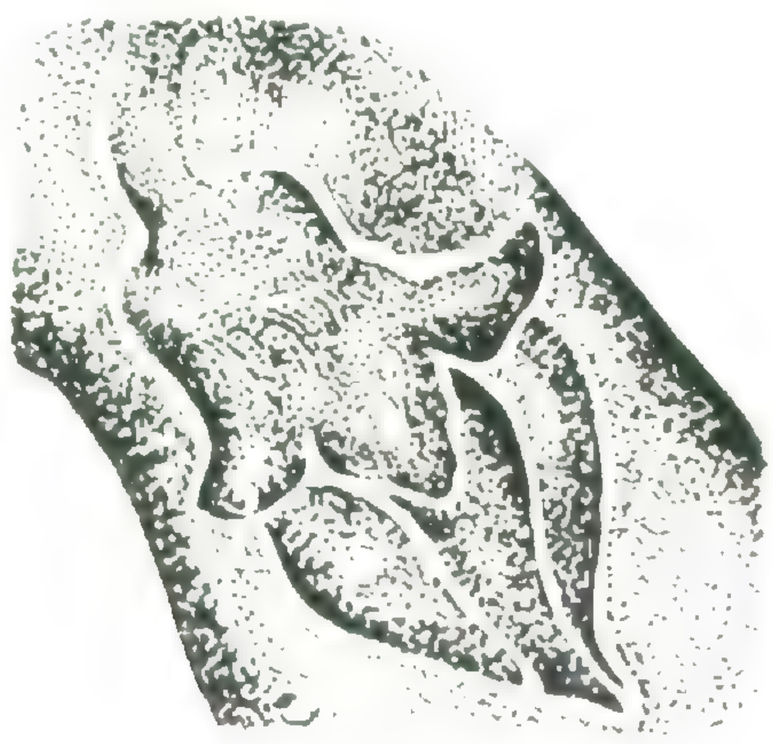


Fig. 5
The Morning Glory flower emerging. (See Plate XXVI.)

A series of pointed objects hang from the pectoral, four visible in our front view of the statue and others from the side views near the shoulders. There are similar carvings around the right ankle. These are ordinarily taken to be the claws of an eagle or the fangs of the jaguar or puma and this interpretation may be right. But should we not pause before jumping to an interpretation that in Mesoamerica is conventional and accepted thoughtlessly, without inquiry into the whole context

Plate XXVI

View of Xochipilli, left side.

of the thinking behind the specific expression in art! These motifs might just as well represent the flower of the morning glory in its familiar closed form, either before the flower has opened or when it closes at dusk, a form that would be appropriate for a string of them hanging from a pectoral. Our poet, in the third of our quotations above, sings of the 'necklaces of flowers' and these may well be the necklaces. Here Mrs. Seeler gives us the woodcut (1) of *ololiuhqui* published in 1651 in Francisco Hernández' great herbal of Mexico,[3] a detail (2) of this woodcut showing how easily the closed flowers could serve as a model for what we too casually accept as jaguar's tusks, and a photograph (3) of the ornaments on the statue that we are discussing:

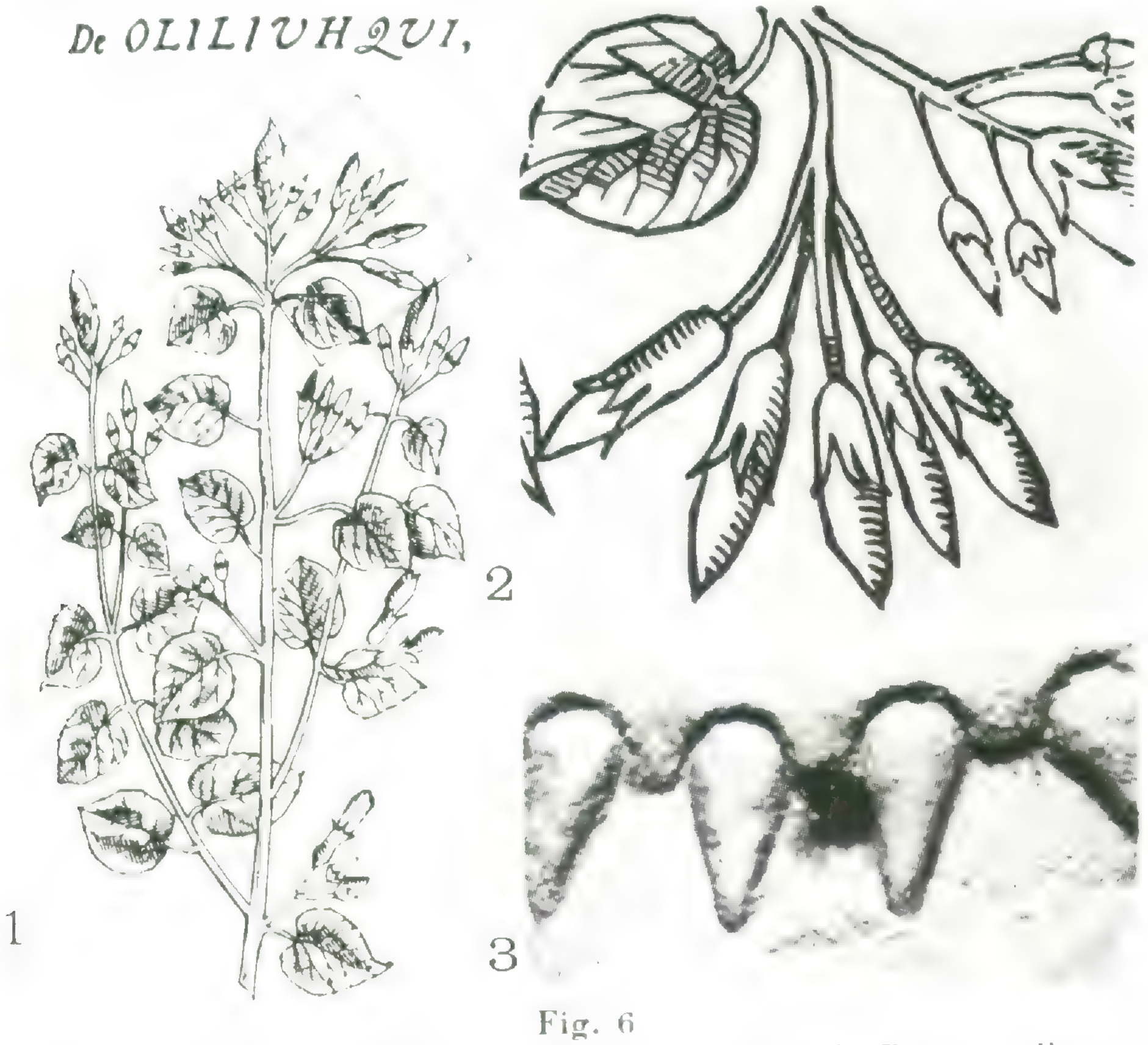


Fig. 6

[3] In this herbal *ololiuhqui* is misspelled *oliliuhqui*. *Rerum medicarum Novae Hispaniae thesaurus, seu plantarum, animalium, mineralium mexicanorum historia*, Rome, 1651, p. 145.

On each shoulder there is a meandering design: could it not be the tendril of the morning glory vine?

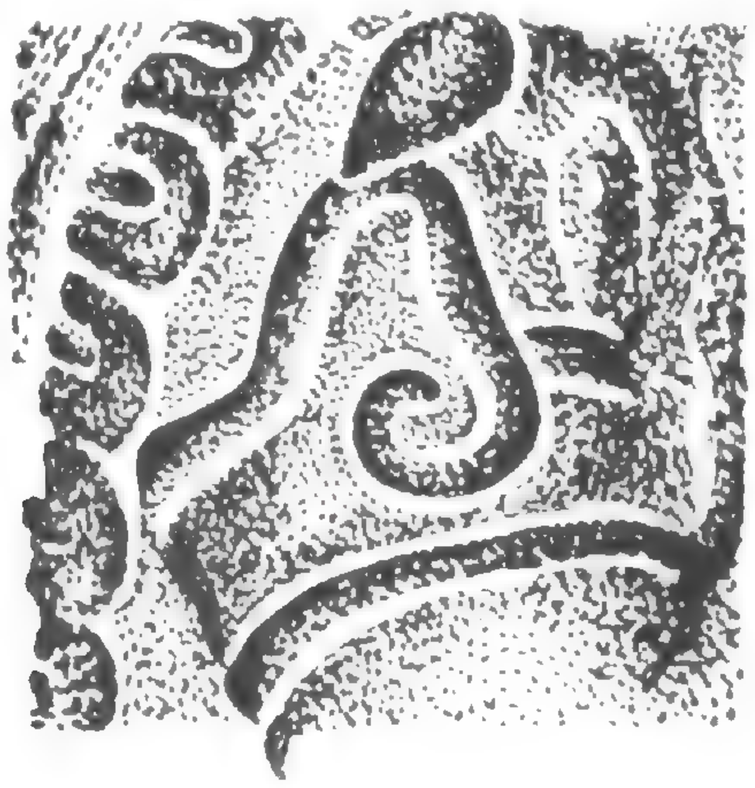
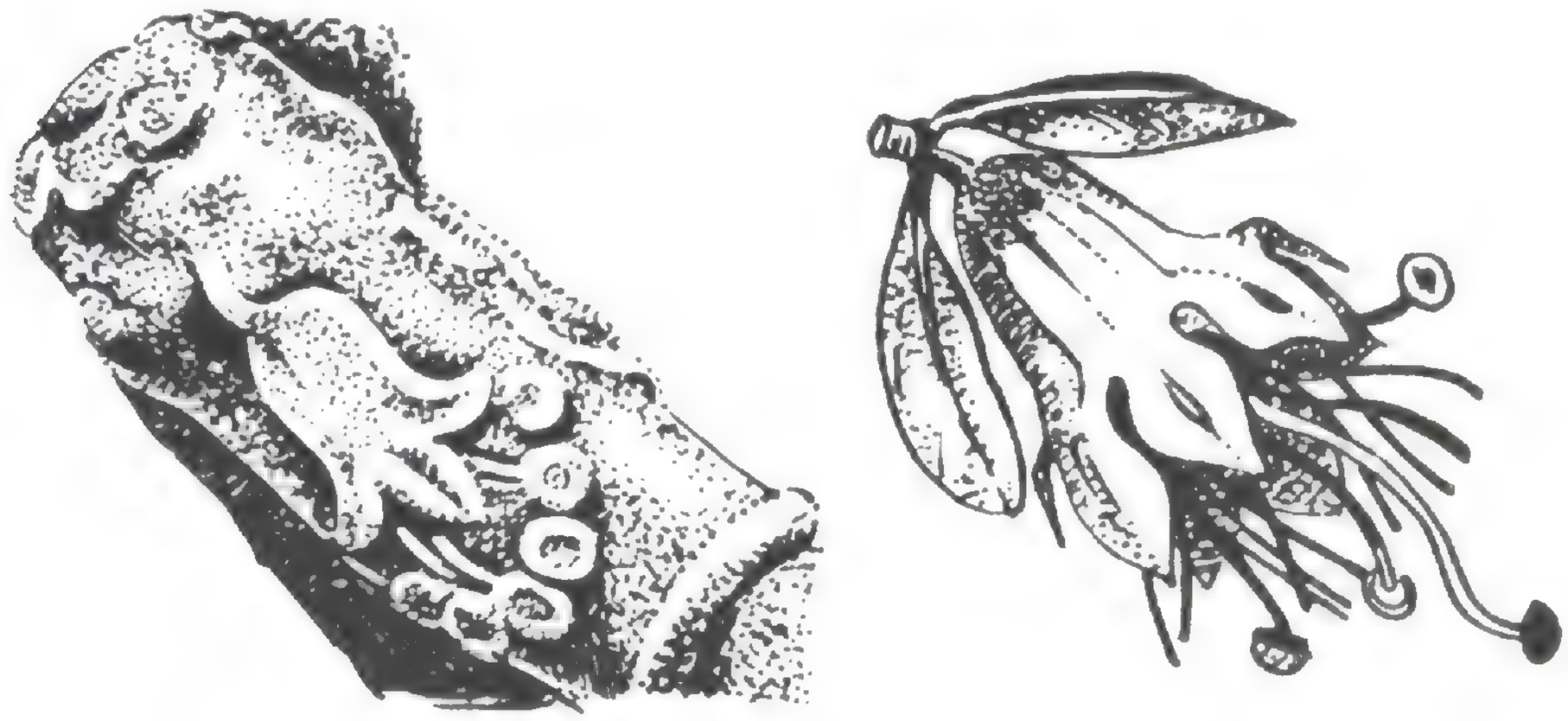


Fig. 7
Tendril of Morning Glory?

So much for *Rivea corymbosa* or *ololiuhqui*.

Schultes is quite certain that he has identified the flower carved on the right leg below the knee: *Heimia salicifolia*, the *sinicuichi* of the Mexican highlands. Here is Mrs. Seeler's comparison of the carving and the actual plant:



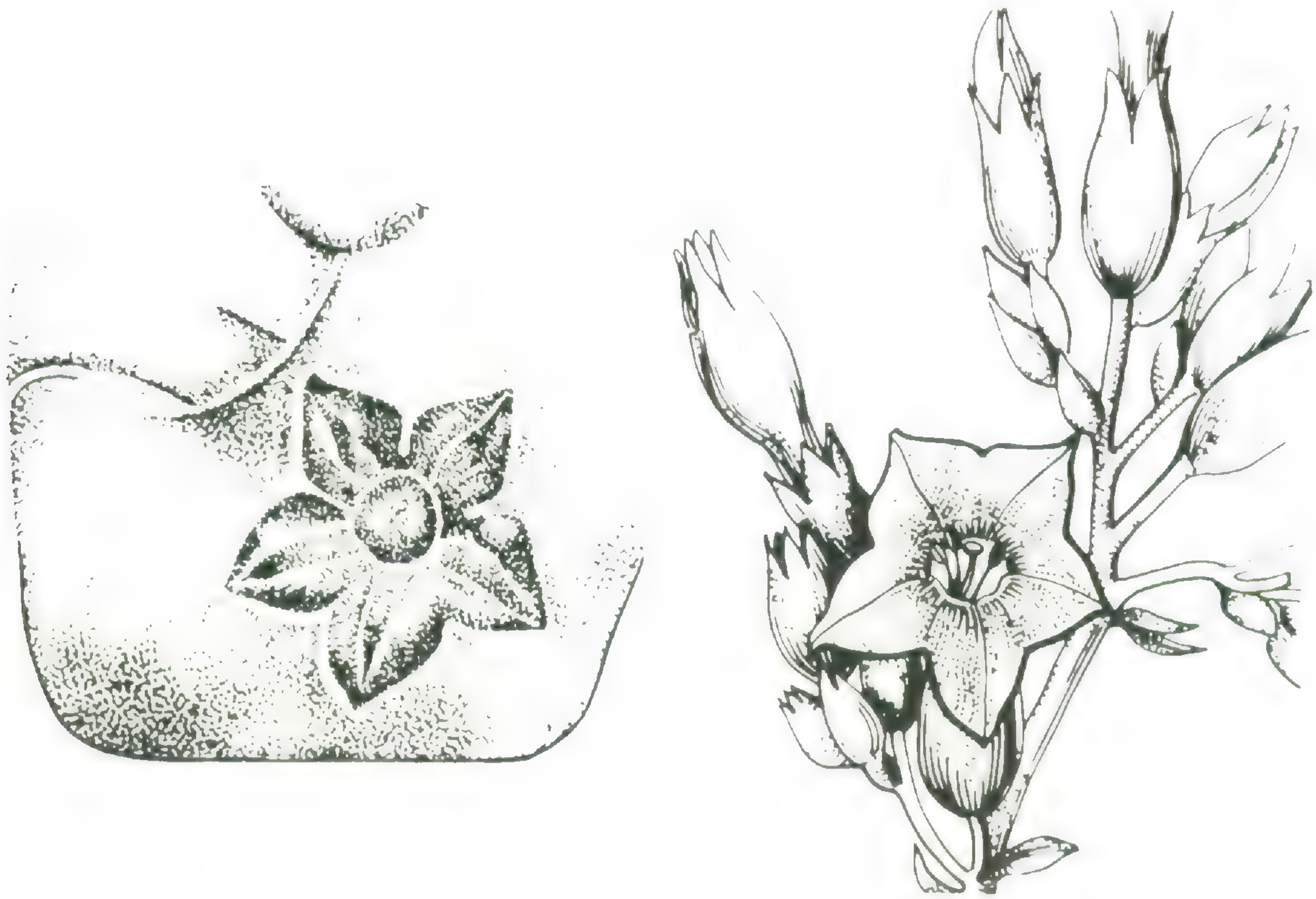
a Fig. 8 b
Heimia salicifolia, *Sinicuichi* of the Nahua

Schultes says that the plant has 'mildly intoxicating properties', and adds these details:

> Sounds seem to come distorted from a great distance. This plant typifies an hallucinogen of which the hallucinogenic characteristics are auditory, not visual. The natives believe that *sinicuichi* has sacred or supernatural qualities, since they hold that it helps them recall events which took place many years earlier as if they had happened yesterday; others assert that they are able, with *sinicuichi*, to remember pre-natal events.

On contemplating the statue anew one is tempted to see in the tilt of the head and above all in the open mouth that Xochipilli is listening to the far-off voices of *sinicuichi*. Mrs. Seeler's drawing (Fig. 8b) is based on the illustration in the *Bulletin on Narcotics*, Vol. XXII, No. 1, January - March 1970, p. 38, from Part III, 'The plant kingdom and hallucinogens', by Dr. Schultes.

Schultes is confident that he and his colleagues have identified another sacred plant of the Nahua: on the



a b

Fig. 9
Nicotiana Tabacum

Plate XXVII

Rear view of Xochipilli.

right thigh of Xochipilli 'where the buttock begins, is the cup of the flower of our everyday tobacco, *Nicotiana Tabacum*, repeated on the left forearm. For the Amerindians the tobacco plant was one of the most holy plants. Mrs. Seeler has reproduced the design on the right thigh (a) and also an illustration of a detail (b) of *N. Tabacum* as shown in the Britton and Brown *Illustrated Flora* edited by Henry A. Gleason, Vol. 3, p. 205.

Two carvings of flowers on the statue of Xochipilli remain. On the left side, just where buttock and thigh meet, a well delineated flower holds our attention, and the same flower appears on the right side of the torso,

Fig. 10
Emerging bud of *Heimia salicifolia?*

above the belt. Schultes, somewhat uncertain, asks whether it could be a swollen bud of *Heimia salicifolia*, just about to open up. As we have seen, *ololiuhqui* (the morning glory *Rivea corymbosa*) is present on the statue at two stages of its growth; why not *sinicuichi* also!

Finally there is the carving on the left side of the torso, just above the belt, with two retroussé curls, clearly defined. Schultes and his colleague, Elmer Smith, subject to a better suggestion from others, think that this may represent *Calea Zacatechichi*. For the Chontal Indians of Oaxaca the leaf of this plant is the *thle pela kano*, the 'leaf of god', and they use it 'for the clarification

Detail of Xochipilli showing mask as evidenced in eye-socket and under chin.

of the senses' in divination. The divinatory use of this composite in an infusion and by smoking was discovered a few years ago and revealed by Thomas MacDougall in the *Garden Journal* of the New York Botanical Garden, July–August 1968 issue. Until now the practice

Fig. 11
Inflorescence of *Calea zacatechichi?*

has been reported only among the Chontal of Oaxaca. Since the plant occurs widely in central Mexico, may we assume that the Nahua in the Valley of Mexico were also familiar with its virtues? It will be observed that in this instance, as well as in all the others, the carvings on the statue bear no relation in size to the flower or mushroom that is represented: each flower is magnified to fill suitably the space allotted to it.

In Nahuatl the hallucinogenic experience was *temiyoch*, the 'flowery dream'. This fits in with our thesis: *xochitl* meant 'flower' but by extension also 'divinatory plant' or the flower of such a plant, and included among those 'flowers' we find *xochinanácatl*, the hallucinogenic mushroom. In poetry and sculpture it seems that the secondary meaning often eclipsed the primary sense.

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TYPIFICATION OF *CANNABIS SATIVA* L.

BY
WILLIAM T. STEARN[1]

The possibility that the genus *Cannabis* (Cannabaceae) comprises more than one species, as believed by Zhukovsky (1962) and other Russian botanists and as noted by Tutin *et al.* in *Flora Europaea* 1: 67 (1964), or consists of one variable species divisible on fruit characters into several subspecies with differing chemical properties, has made it essential to examine the typification of the name *Cannabis sativa* so as to remove in advance any nomenclatural uncertainty which may otherwise come about if, for taxonomic reasons, the Linnaean epithet *sativa* has to be restricted to one member of the group.

The name *Cannabis sativa* L., having been published by Carl Linnaeus in his *Species Plantarum* 2: 1027 (1753), the internationally accepted starting point for modern botanical nomenclature, is the first legitimate scientific name for the hemp which was grown in Europe in the 18th Century. Here it had been extensively cultivated for many centuries, as is evident from both historical and palynological evidence (summarized by H. Godwin in 1967), being grown primarily for its tough fibres providing cordage and clothing but also for its oily seeds; fortunately, during the period of its maximum use in Europe, the narcotic properties of its resin were unknown there.

[1] British Museum (Natural History), London.

The flowers of hemp are either male (staminate) or female (pistillate). Normally an individual plant bears either male or female flowers but not both. Male and female individuals differ in appearance and longevity, the males having conspicuous loose few-leaved inflorescences and dying earlier than the females, which have compact more leafy inflorescences with much less conspicuous flowers.

Growers of hemp have probably always been familiar with the differences between male and female plants and have long distinguished them as such in a metaphorical manner completely opposed to their biological nature. According to Lefranc (1905), Antoine Rabelais, the father of François Rabelais (c. 1494-1553), grew much hemp on his property at Cinais, southwest of Chinon (Indre et Loire), and young Rabelais probably helped in its cultivation. Rabelais certainly knew everything known then about the character and cultivation of hemp; three chapters of his *Le Tiers Livre des Faictz et Dictz Héroiques du Noble Pantagruel* (1546) are devoted to *l'herbe nommée Pantagruelion*, which is simply hemp. Rabelais here duly mentioned its sexuality: 'Et, comme en plusieurs plantes sont deux sexes, masle et femelle, ce que voyons es lauriers, palmes, chesnes, heouses, asphodele, mandragore, fougere, agaric, aristolochie, cypres, terebynthe, pouliot, peone, et aultres, aussi en ceste herbe y a masle qui ne porte fleur aulcune, mais abonde en semence, et femelle, qui foisonne en petits fleurs blanchastres, inutiles, et ne porte semence qui vaille, et comme est des aultres semblables, ha la feuille plus large, mains dure que le masle, et ne croist en pareille haulteur' (Livre 3, chap. 49).

Sir Thomas Urquhart in his 1693 translation came closer to the original than he usually did, being swept along by his exuberant love of words which Rabelais

would have appreciated, when he rendered this into English as follows: 'And as in diverse plants and trees there are two sexes, male and female, which is perceptible in laurels, palms, cypresses, oaks, holmes [i.e. holm-oaks], the daffodil [i.e. asphodel], mandrake, fern, the agaric [i.e. mushroom], birthwort, turpentine, penny-royal, peony, rose of the mount and many other such like, even so in this herb there is a male which beareth no flower at all, yet it is very copious of and abundant in seed. There is likewise in it a female, which hath great store and plenty of whitish flowers, serviceable to little or no purposes, nor doth it carry in it seed of any worth at all, at least comparable to that of the male. It hath also a larger leaf and much softer than that of the male, nor doth it altogether grow to so great a height'. The seed-bearing hemp called 'male' here is, of course, the female plant and the sterile hemp here called 'female' is really the male.

Most pre-Linnaean botanical authors, except Ray and Morison, applied the terms *mas* (male) and *foemina* (female) in the same metaphorical way as Rabelais, without any concept of true sexuality in plants comparable to that of animals. Thus, of two kinds, usually distinct species, the more robust or more vigorous or more useful one, especially if having larger leaves or harder wood, was designated 'male' and the inferior one 'female'. Hence, the names *Cannabis sativa* and *C. mas*, as used by Dalechamps, Dodoens and C. Bauhin, refer to female individuals of hemp; and the names *C. erratica*, *C. foemina* and *C. sterilis* refer to male individuals. The name *Cannabis sativa*, which Linnaeus used as a specific name covering both sexes, applied originally only to female individuals. This kind of usage died slowly. As late as 1884, Saint-Lager noted, in his erudite 'Remarques historiques sur les mots "plantes mâles" et "plantes fe-

melles'' ', that farmers in the Rhône basin were still calling pistillate plants of hemp 'chanvre mâle' and staminate plants 'chanvre femelle', because the pistillate plants remained green and robust after the weaker staminate plants had withered, their function as pollinators fulfilled.

In the same manner, C. Bauhin designated the useful female hop-bearing plant of *Humulus Lupulus* as *Humulus mas* and the unproductive male as *H. foemina*.

The difference between male and female plants of hemp necessitates two periods of harvesting. Thus, Philip Miller in his *Gardeners Dictionary*, 8th ed. (1768), recorded that in the east of England 'the first season for pulling the Hemp, is usually about the middle of August, when they begin to pull what they call the Fimble Hemp, which is the male plants . . . . These male plants begin to decay soon after they have shed their farina. The second pulling is soon after Michaelmas, when the seeds are ripe: this is usually called Karle Hemp, it is the female plants, which were left at the time the male were pulled'.

The fruit is a small nut, i.e. it has a single seed tightly covered by the hardened wall of the ovary, and is enclosed within a sheathing hairy bract with abundant resin glands which presumably developed in the wild as a protection for the fruit against insects, like the glandular trichomes of other plants (cf. D. A. Levin, 1973). The distinctions, which have been made between the taxa known as *C. sativa*, *C. indica* and *C. ruderalis*, relate to characteristics of the fruit; male plants seemingly provide no diagnostic features; hence for typification a pistillate specimen would be preferable to a staminate one on taxonomic as well as historic grounds.

Linnaeus's protologue in the *Species Plantarum* 2: 1027 (1753) is as follows:

Plate XXIX

Pistillate specimen of Cannabis in the Clifford Herbarium at the British Museum (Natural History), London. This specimen has been taken as lectotype of the name *Cannabis sativa* L.

Courtesy: British Museum (Natural History).

Cannabis foliis digitatis. *Hort. cliff* 457.
Hort. ups. 297. *Mat. med.* 457.
Dalib. paris. 300. *Roy. lugdb.* 221.
Cannabis sativa. *Bauh. pin.* 320. ♀
Cannabis mas. *Dalech. hist.* 497. ♀
Cannabis **erratica**. *Bauh. pin.* 320. ♂
Cannabis femina. *Dalech. hist.* 497. ♂
Habitat in India.

Several matters in this protologue call for comment. In genera with several species, Linnaeus provided concise diagnostic phrase-names enabling the species thereby to be distinguished, e.g. *Hippophaë foliis lanceolatis* and *Hippophaë foliis ovatis* for *H. Rhamnoides* and *H. canadensis*. Such phrase-names were comparative; they contrasted specific features. In a genus with only one species, such as *Cannabis*, no such diagnostic phrase was required and would indeed have been illogical, since obviously the one and only species could not be contrasted with itself.

Typification of the generic name of such a monotypic genus is essentially the same as typification of the specific name; the nomenclatural type of the one must be the nomenclatural type of the other. Hence, the generic name *Cannabis* L. and the specific name *Cannabis sativa* L. must be permanently associated with the same element. The *Species Plantarum* citations of literature begin with Linnaeus's own *Hortus Cliffortianus* (1738), where fuller synonymy will be found; the other citations likewise refer to plants cultivated in Europe. He used the terms *mas* and *femina* and the signs ♂ and ♀ for male and female plants in a purely biological sense and sorted his synonyms accordingly. Knowing hemp only as a cultivated plant in Europe, he evidently assumed that it must have been introduced from elsewhere, presumably

Plate XXX

Staminate specimen of Cannabis in the Clifford Herbarium of the British Museum (Natural History), London.

Courtesy: British Museum (Natural History).

Asia; he had earlier identified with this the male plant figured under the name 'Kalengi-cansjava' in Rheede, *Hortus Malabaricus* 10: t. 60 (1690) and, with some doubt, the female plant figured there in t. 61 (1690); on this evidence, it would seem, he stated 'Habitat in India'. These Rheede illustrations were later cited by Lamarck under his *Cannabis indica* when he separated that as a species distinct from *C. sativa*.

Linnaeus's account of *Cannabis sativa* in the *Species Plantarum* (1753) is to be associated with the description of the genus *Cannabis* in his *Genera Plantarum*, 5th ed., 453, no. 988 (1754), as stated in the *International Code of Botanical Nomenclature* art. 13, note 3 (1972). This description is as follows:

988. CANNABIS* *Tournef.* 308

* *Mas*

CAL. *Perianthium* quinquepartitum: *foliolis* oblongis, acuminato-obtusis, concavis.

COR. nulla.

STAM. *Filamenta* quinque, capillaria, brevissima. *Antherae* oblongae, tetragonae.

* *Femina*

CAL. *Perianthium* monophyllum, oblongum, acuminatum, latere altero longitudinaliter dehiscens, persistens.

COR. nulla.

PIST. *Germen* minimum. *Styli* duo, subulati, longi. *Stigmata* acuta.

PER. minimum. *Calyx* arcte clausus.

SEM. *Nux* globoso-depressa, bivalvis.

The asterisk in the heading CANNABIS* here, as in the first edition, indicates that Linnaeus had based his account on living material, i.e. on plants cultivated in Sweden or Holland. This 1754 description comes, however, unchanged from the first edition of the *Genera Plantarum* 304, no. 749 (1737) published at Leyden, when Linnaeus had charge of Clifford's richly stocked garden at Hartekamp. That work, dealing with the

genera, and his *Hortus Cliffortianus* (1738), dealing with the species, have the same close association as the 1754 *Genera Plantarum* has with the 1753 *Species Plantarum*. Thus, his principal reference under *Cannabis* in the 1753 *Species Plantarum* is to the *Hortus Cliffortianus* 457, which, in turn, refers to the 1737 *Genera Plantarum* no. 749.

In the *Hortus Cliffortianus*, Linnaeus provided a short diagnosis, *Cannabis foliis digitatis*, to distinguish the true hemp from a then imperfectly known plant diagnosed there as *Cannabis foliis pinnatis*, but named *Datisca cannabina* in the first edition of the *Species Plantarum*. In short, Linnaeus's concept of *Cannabis sativa* in 1753 is identical with that of his *Cannabis foliis digitatis* of 1738. Just as John Ray had earlier distinguished functionally male individuals as *Cannabis sativa* '*mas s. sterilis*' and female individuals as *Cannabis sativa* '*foemina s. fertilis*', so Linnaeus likewise distinguished male and female individuals, allocating pre-Linnaean synonyms to each. The material of *Cannabis* which Linnaeus had for study when preparing the *Genera Plantarum* (1737) and *Hortus Cliffortianus* (1738) is fortunately represented in the Clifford Herbarium, Hortus siccus Cliffortianus, in the Department of Botany, British Museum (Natural History), London, by two good specimens, one (A) male (Plate XXIX), the other (B) female (Plate XXX). Either is available for designation as lectotype. Since, however, the major characters for taxonomic division in *Cannabis* come from fruiting material, *the Hortus siccus Cliffortianus fruiting specimen* (*p. 457 Cannabis no. 1, B*) of *Cannabis sativa* L. is here designated as the *lectotype*. This specimen represents *C. sativa* as currently commonly accepted. The fruit is about 5 mm. long, 3.5 mm. broad.

If Linnaeus had provided in 1753 a new diagnosis for

Cannabis sativa or had modified in 1754 the generic description of *Cannabis* published in 1737 on the basis of later material—as he did for some other species and genera—then it would be judicious to select a lectotype from this material influencing his final concept of these. In fact, however, he did neither. Hence, as indicated above, the lectotype has to be taken from the earlier material on which his unchanged concepts were based. From this standpoint, the two specimens under *Cannabis* in his herbarium at the Linnean Society of London have only a subsidiary relevance, because they in no way affected his publications. They are, however, of interest on account of their Linnaean association. Linnaean Herbarium specimen 1117.2, illustrated in Joyce & Curry, *Botany and Chemistry of Cannabis* 22 (1970), is a pistillate plant, with fewer than the usual number of leaflets, which are narrowly lanceolate, long acuminate and sharply serrate. It has no epithet but is numbered '1' in Linnaeus's hand.

Linnaeus began to draft his *Species Plantarum* long before he devised his method of consistent binomial nomenclature for species: even in 1748, he had not devised binomials for the whole vegetable kingdom; hence the most convenient method of arranging and designating his herbarium specimens was to number the species in each folder according to the numbered species entries in his manuscript *Species Plantarum*. When, a few years after 1753, he began to prepare a second edition of the *Species Plantarum*, with changed numbering of specific entries, he ceased to number his specimens but added instead the specific epithet introduced in that work. Thus, a numeral corresponding to an entry in the first edition of the *Species Plantarum* is a valuable indication that Linnaeus possessed this specimen in 1753 or acquired it soon afterwards.

Hence, the numbered pistillate specimen with leaflets characteristic of European hemp, *Linn. Herb. 1177.2*, can be assumed to have been in his hands at this time if not much earlier. The other specimen, *Linn. Herb. 1177.1*, illustrated in Joyce & Curry, *Botany and Chemistry of Cannabis* 21 (1970), is of very different aspect. It is a staminate plant with much shorter and broader almost obtuse more coarsely serrate leaflets. It has no number but is labelled 'sativa' in Linnaeus's hand. Thus, this specimen, in no way typical of *Cannabis sativa* as commonly accepted, can safely be assumed to have come into Linnaeus's possession later than 1753.

The two *Hortus Cliffortianus* specimens belong to the old cultivated hemp stock of northern Europe. This is represented by another contemporary herbarium specimen in the British Museum (Natural History) which was grown in the Chelsea Physic Garden and presented in 1740 to the Royal Society of London under the number 908; for a discussion of the history and nomenclatural importance of these Chelsea specimens, see Stearn (1972). There are also specimens scattered through the herbaria assembled by Sir Hans Sloane (1660–1753) and now in the British Museum (Natural History): vol. 39, fol. 2 (c. 1660), vol. 83, fol. 161 (L. Plukenet, 1642–1706), vol. 85, fol. 62 (G. Bonnivert, fl. 1673–1703), vol. 91, fol. 47 (Plukenet), vol. 117, fol. 2 (A. Buddle, 1660–1715), vol. 167, fol. 393 (G. London, d. 1713), vol. 321, fol. 236 (H. Boerhaave, 1668–1738): see J.E. Dandy (1958).

Summary

Although Linnaeus, when publishing the name *Cannabis sativa* in 1753, gave 'India' as the country of origin of the species, he based his original description on the hemp grown in northern Europe in 1737, which he knew in a living state; this hemp belonged to the long-

cultivated European stock which Rabelais had described at length in 1545 under the fictitious name 'Pantagruelion'. Linnaeus, like his predecessor Ray, correctly distinguished the staminate individuals as 'male' and the pistillate and fruiting individuals as 'female'. Most pre-Linnaean authors, on the general masculine assumption that males were superior or more robust or more useful than females, metaphorically designated the relatively useless male individuals as 'female' and the fruit-bearing female ones as 'male'. A female (pistillate) cultivated specimen in the Clifford Herbarium at the British Museum (Natural History), London, is taken as lectotype of the name *Cannabis sativa* L.

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CANNABIS: AN EXAMPLE OF TAXONOMIC NEGLECT

BY

RICHARD EVANS SCHULTES,[1] WILLIAM M. KLEIN,[2]
TIMOTHY PLOWMAN[3] AND TOM E. LOCKWOOD[4]

The story of marijuana
is not yet written.
—H. H. NOWLISS

I

It is often true that we know less about the classification of our widely cultivated plants than we do about some of the rare wild species of limited or endemic distribution. The cultivation and dispersal of a domesticated plant tend to alter the organism in many ways, often so drastically that it may be difficult or even impossible to point to a wild species as its progenitor. Sometimes the plant is so dramatically changed that it becomes wholly dependent on man for its survival (21).

The genus Cannabis provides an excellent example of an important group of useful plants the classification of which has long been clouded in uncertainty. One of man's oldest domesticates, dating back nearly to the beginnings of agriculture, Cannabis as we now know it has developed together with man as a multi-purpose economic plant:

[1] Paul C. Mangelsdorf Professor of Natural Sciences and Director, Botanical Museum, Harvard University.

[2] Assistant Director, Missouri Botanical Garden.

[3] Research Fellow in Economic Botany, Botanical Museum, Harvard University.

[4] Assistant Professor of Botany, University of Illinois, Urbana.

the source of a fibre, a narcotic, a medicine, an oil, and an edible fruit (2, 7, 13, 19, 20).

Native apparently somewhere in central Asia, where it occurs as a plant of open, disturbed habitats, such as riverbanks, bottomlands, and hillsides, hemp has spread to all parts of the world where conditions are suitable for its growth: in fact, it is at present one of the most widely disseminated cultivated plants (4, 18, 29, 31).

The effects of man's subconscious and later conscious selection for desirable characteristics combined with the effects of natural selection under the stress of new and sometimes inhospitable environments have acted significantly in morphologically and perhaps chemically altering the Cannabis plant. As a result, today, possibly some 10,000 years after the beginnings of the man-hemp partnership, Cannabis has become one of the most variable of cultivated plants.

It is precisely this variability and our lack of anything approaching a full understanding of its nature and extent that have created a most difficult problem for systematists who have attempted to delimit specific and subspecific boundaries in the genus.

Unlike some domesticated plants, Cannabis is believed still to occur in wild populations in certain parts of Asia and to exhibit in these populations an appreciable amount of inherent natural variability (5, 29). Man took advantage of this variability as he domesticated Cannabis by cultivating and artificially selecting for a number of useful traits, such as elongated bast fibres, large seeds with high oil content and copious production of narcotic resin. Under the pressures of selection for these characters, Cannabis began to reveal characters and combinations of characters not found in wild or presumed wild populations, a phenomenon that has occurred in every plant domesticated by man.

Unlike many of man's other cultivated plants, however, hemp never became totally dependent on man. In many areas where hemp was cultivated, it readily escaped and became naturalized as an aggressive weed. Thus released from the pressures of artificial selection induced by cultivation, populations of naturalized Cannabis underwent extensive adaptive radiation.

In this new role, Cannabis invaded many disturbed habitats, especially habitats newly created by man, becoming established and spreading without man's direct intervention. Like many other weeds, hemp became one of man's camp followers along roadsides and in rubbish heaps and growing on the edges of fields (1, 2, 3, 29). The changes invoked by the transition from domestication to naturalization included, at least in some cases, reversions to characteristics peculiar to wild hemp, as has been known to occur in other cultivated plants.

We thus perceive three "phases" of Cannabis—the wild, the cultivated, the weedy. These "phases" are not necessarily three discreet states of existence. The last two "phases", occurring over vast areas of the world and under highly varied ecological conditions, have created the great array of phenotypic diversity which we witness today in cultivated and naturalized hemp. Cannabis in the wild state has probably adapted well to disturbed conditions. Its wild adaptive mode pre-adapted it in many cases to certain cultivated conditions and often made an easy transition back to the weedy state or "phase" (4, 19, 20, 29, 30).

As a result of the extraordinary plasticity and variability evident in present-day cultivated and weedy Cannabis, there can be no hope of unravelling the complexities encountered in the genus through a study of cultivated types alone. No certain progress can be effected, until the biology of wild or presumably wild populations

are carefully investigated—and it must constantly be borne in mind that there can be no *wild* hemp except in areas where it is native. The most critical studies on cultivated or weedy types of Cannabis—in Europe, North America and South America, for example—can yield little new evidence towards an understanding of the species composition of the genus. There have been enough examples of cultivated plants the classification of which has been clarified as a result of an investigation of wild ancestral types, of wild populations or of related wild species to indicate the desirability and necessity of this approach in the case of Cannabis.

II

Although the taxonomic literature on Cannabis is complicated by a confusing plethora of specific and varietal names (most of which have never been properly published or described, according to the rules of botanical nomenclature), the genus has been and still is generally considered to be monotypic.

We are persuaded that this opinion is the result of an almost total lack of taxonomic investigation of wild Cannabis as it occurs in its natural habitat or even of comprehensive and comparative studies of the range of variation found in cultivated hemp. Since botanists have not carried out such detailed and critical taxonomic studies, it has naturally been customary for authors of text-books, check-lists, floras, manuals, botanical dictionaries, pharmaceutical publications, agricultural treatises and other generalized and summary-type publications to repeat the orthodox monotypic concept, thus establishing it even more firmly in the literature. This establishment of the monotypic concept is reflected in modern chemical publications and even in the drafting of laws in some of the countries that control the use of Cannabis.

A polytypic concept of the genus is not new. It goes

back 190 years to Lamarck's recognition of a collection from India as distinct from the species which Linnaeus thirty years earlier had named *Cannabis sativa*.

As an outcome of investigations carried out by Russian students of crop plant evolution in the 1920's and 1930's, the opinion that there are indeed several species of Cannabis was, for the first time, offered on the basis of studies and experience in the field. They are the only taxonomists to have studied extensively wild populations of Cannabis. Their work, however, has not been widely accepted. Failure to accept or at least to consider seriously their opinions has been the result of several factors: partly because their work was published in Russian in journals of limited availability; partly because western botanists were not able to visit the areas of presumed wild Cannabis in Russian territory; and perhaps most significantly because of conservative unwillingness to contemplate change in the established belief in the monotypic nature of the genus.

We began to question the generally accepted view of Cannabis as a monotypic genus in 1969, when one of the writers (Schultes) was invited to address a symposium in London composed mainly of chemists and pharmacologists. He was asked to address himself to what is *not* known about the botany of Cannabis. Although, in that lecture, essentially a review of the literature, he clung to the idea of the monotypic nature of the genus, his evaluation of the limited taxonomic studies raised serious doubts in his mind about the propriety of this viewpoint (19). Subsequent critical studies of the literature; examination of material from many areas preserved in several of the world's largest herbaria; preliminary field work in Afghanistan; and a survey of the plantings of Cannabis in Mississippi from seed imported from many localities around the world under the auspices of the National Institutes of Health—all have combined to convince us

that Cannabis is not monotypic and that the Russian concept that there are several species may be acceptable.

It is not only the Russian sources (10, 29, 30, 31) that accept the polytypic concept of Cannabis. The British taxonomists who are editing *Flora Europaea* (28) clearly indicate their belief that two species occur within the confines of the floristic area which they consider Europe. Although they have not published their opinions, several American taxonomists who have examined the evidence likewise favor the polytypic concept.

Other botanists who still maintain the monotypic nature of Cannabis are receptive to the possibility that continued study may indicate more than one species. After a careful taxonomic evaluation of Cannabis on a generic basis, for example, Miller (14) suggested that only additional investigations could clarify the variability in characters on which several species have been set up. And Small (22), who has carried out extensive cytological research on Cannabis, has stated that . . . "there would not appear to be a basis for recognizing species or other taxonomic groupings in Cannabis on the criterion of breeding isolation . . . [that] some of the numerous taxonomic entities that have been recognized . . . may be justified on the basis of morphological ground but, as no comprehensive morphological study of Cannabis has yet been published, all recognized taxa in Cannabis must be viewed with suspicion at present."

A complete clarification of the biology and systematics of Cannabis will, of course, require extensive field studies in those areas of Asia where the genus is presumably native or at least has not been subjected to intensive agricultural influence. Sufficient research has not been carried out to establish all of the general trends in the specific delimitation of the genus. Important aspects still remain unclear. Whether there are two or three—or

possibly even more—species is still open to question, as is the correct nomenclature of the specific concepts involved.

But in the basic question of whether Cannabis be monotypic or polytypic, we have little hesitation with the evidence available at this point in accepting the polytypic concept.

Central Asia and adjacent regions to the south and west comprise a vast area which includes a great diversity of geographical zones and ecological situations. It is here that Cannabis is commonly believed to have originated, although it may be difficult to pinpoint any specific area of origin or to determine how great the geographical distribution of wild hemp was before the advent of man (5, 29, 31). In such a region, there could easily have arisen divergent populations sufficiently distinct both morphologically and ecologically, to be considered species, subspecies and varieties.

When man began to domesticate one or more of these species of Cannabis and carry them from place to place, hybridization occurred between the wild species and the incipient cultigens.

Through continual introgressive hybridization with cultivated hemp, some of the original wild species of Cannabis may have gradually become extinct. This process increased the variability in the gene pool of the cultivated plants and must have imparted to them some of the unique characters of the wild species. This belief is given credence by the fact that we find great morphological variation between populations of cultivated hemp in various parts of Eurasia in characters which have *not* been selected for by man, such as leaf size and shape and pigmentation of stem and fruit.

Studies in the reproductive biology of different strains of cultivated Cannabis indicate that these plants are fully interfertile (17, 22). This does not mean, however, that

sterility barriers may not exist within the genus, specifically in wild populations which have not yet been examined for this character. They may, indeed, show varying degrees of reproductive isolation.

Reproductive isolation can, of course, occur by means other than sterility barriers. It is well known that, in certain genera of plants, as in some animals, "acceptable" species exist where there are few or no sterility barriers present. The examples are many. These species have evolved with other types of isolating mechanisms, that are either mechanical, ethological or geographical.

The significant phenomenon in Cannabis is that the combinations of morphological and anatomical (and possibly also chemical) characters have maintained their in. tegrity, in spite of hybridization. The maintenance of these combinations of characters is a better indication of these reproductive barriers than that resulting from experimentation with cultivated strains of doubtful origin.

It is, furthermore, well recognized that species concepts must necessarily vary from one genus to another and from one family to another, dependent on the genetic peculiarities of the group under consideration. With the very different genetic backgrounds in different families, genera, etc., it is not at all surprising that the patterns of variation in these sundry groups may be quite different. There is not the equivalence of units amongst families of plants in the same sense of elements in chemistry. At one time, it was hoped that the species might be so rigorously defined that it would serve as the unit of evolution. Taxonomy has come a long way, however, since this belief, and taxonomists now hold that the population is the evolutionary unit, the biologically significant unit in plants.

Plants were not made to be catalogued and classified. They can never easily and with complete satisfaction be

put into tight compartments. This simple and basic truth, usually not appreciated by non-scientists and sometimes overlooked by zealous taxonomists, should be borne in mind much more strongly for groups such as Cannabis, where an historical perspective is imperative.

III

In view of the excessively confused taxonomic picture of Cannabis that at present confounds botanical, chemical, legal and other considerations, a review of the specific history of the genus may be illuminating.

The history of *Cannabis* in modern taxonomic literature began in 1737, when Linnaeus established the genus *Cannabis*, basing it on pre-Linnaean concepts.

The name *Cannabis* (Greek *Κάννabis*, Kannabis) is a very ancient classical vernacular name for hemp, with which the English word *hemp* itself, derived from the Anglo-Saxon *haenep* and the presumed Old Teutonic parental form *hanapiz*, are cognate; and, according to Laufer (11), "is presumably a loan word pointing to Finno-Ugrian and Turkish", ancient languages of central Asia. Indeed, the principal difference between the Teutonic and the Graeco-Latin forms is due to the Gothonic consonant shift—Greek preserving the consonant *k* of an earlier Indo-European language which became *h* some five centuries or so B.C. in the primitive Teutonic languages. Thus, etymology accords with other evidence in indicating central Asia as the area whence plants of *Cannabis* spread outwards, mainly eastward, westward and to the south.

The binomial *Cannabis sativa* was published by Linnaeus in *Species Plantarum* in 1753, the internationally accepted starting point for modern botanical binomial nomenclature. *Cannabis sativa* hearkens back to pre-Linnaean literature.

Under *Cannabis sativa*, Linnaeus referred to several

earlier synonyms: *Cannabis foliis digitatis*, used in his *Hortus Cliffortianus* of 1738; *C. sativa* and *C. erratica* of Bauhin in 1623; *C. mas* and *C. femina* of D'Aléchamps in 1587.

The Linnean Society of London preserves in the Linnean Herbarium two species of Cannabis. One specimen, No. 1177.1*, is labelled "*sativa*" in Linnaeus' handwriting and represents a staminate plant with much more abbreviated leaves than is usual for what we consider normal for *Cannabis sativa*. The other specimen, No. 1177.2*, without any specific epithet written on the sheet, represents a pistillate plant with the lanceolate leaflets that are commonly encountered in *Cannbais sativa*.

No locality data are found on these two collections, although, in *Species Plantarum*, Linnaeus offers the information that the species has a "habitat in India". In his annotated copy of *Species Plantarum*, preserved in the Linnean Society, Linnaeus had written in his own hand, as a note for any future edition, the word "Persia" as an additional habitat. It should, of course, be borne in mind that, in Europe in 1753, geographical delimitations were far from strict and that "habitat in India" and "Persia" represented extremely vague and wide areas, undoubtedly not corresponding precisely with today's India and Persia. Indeed, Linnaeus' "India" is often equivalent to modern China.

It is clear that these two specimens were not in Linnaeus' herbarium in 1753. He added them later. Linnaeus did not cite any specimens in his *Species Plantarum*, nor did he offer any description of his *Cannabis sativa*. He based his recognition of *Cannabis sativa* on the kind of hemp commonly cultivated in northern

* Index number assigned to specimen in the Linnean Herbarium by the late M. Spencer Savage, Secretary of the Linnean Society of London.

Specimen No. 1177.1 of Cannabis in the Linnean Herbarium.
Courtesy: Linnean Society of London.

European gardens at that period. Stearn (24) has typified *Cannabis sativa* by choosing as lectotype a pistillate specimen from *Hortus Cliffortianus* and now preserved in the British Museum (Natural History). Until this typification was made, there might well have been doubt as to what Linnaeus actually meant by *Cannabis sativa*, regardless of the general use of this binomial for more than two centuries.

Although the two specimens in the Linnean Herbarium are of little taxonomic or nomenclatural significance, since neither one can be a type, there seems to be no reason to doubt that Linnaeus considered them to represent what he had already called *Cannabis sativa*. Consequently, it would be of interest if we could somehow ascertain the provenience of these two specimens. His annotation "habitat in India" does not constitute a guarantee that he had seen specimens that actually had come from Asia. Linnaeus was, of course, familiar with hemp as cultivated in northern Europe, including his native Sweden, and there is a strong probability that these two later specimens may have been locally collected.

Although very scanty, the two specimens in the Linnean Herbarium are of very different aspect. The pistillate specimen (1177.2) has leaves with fewer than the usual number of leaflets; the leaflets are long, linear-lanceolate, long-acuminate, with very sharply pointed but not coarse serrulation. The staminate specimen (1177.1) is very distinctive, with trifoliate leaves, the leaflets of which are short, elliptic to somewhat elliptic-lanceolate, apically almost blunt, with coarse, not markedly pointed serrulation.

Even though the type method in taxonomy was not employed in Linnaeus' time and although Linnaeus did not have these two specimens at hand in 1753, it is interesting and perhaps significant that the staminate

Specimen No. 1177.2 of Cannabis in the Linnean Herbarium.
Courtesy : Linnean Society of London.

specimen (1171.1), which does not resemble the concept that we now commonly recognize as *Cannabis sativa*, is actually the specimen upon which Linnaeus wrote "sativa". There is no indication of a specific epithet written on the other specimen (1177.2).

With the thousands of herbarium collections now available for study and years of attention to cultivated forms in many parts of the world, taxonomists should be able to examine these two specimens with much more perspicacity than Linnaeus himself was able to do. The question arises—even though this material is not critical to our taxonomic studies in the genus—"Why are these two specimens so very unlike? Was the staminate specimen on which Linnaeus wrote "sativa" a branch from an abnormal plant? Or did perchance Linnaeus actually have at hand after 1753 representatives of two different species?

Although he did no basic taxonomic study on Cannabis, Scopoli, in 1772, twenty years after Linnaeus' publication of *Cannabis sativa* and the name of the hops plants, *Humulus Lupulus*, reduced the genus Humulus to synonymy under Cannabis, calling the hops plant *Cannabis Lupulus*. This point of view has never gained acceptance, although both genera, Cannabis and Humulus, are now almost unanimously considered to be closely allied and to be members of the same family, Cannabaceae.

Thirty years after Linnaeus' *Species Plantarum*, in 1783, the French naturalist Lamarck described another species, *Cannabis indica*, in his *Encyclopédie Méthodique*. This new species was based upon a specimen certainly of Asiatic origin. According to Lamarck, it was collected by a French naturalist, M. Pierre Sonnerat (1748(49)-1814) in India. Again, we are at a loss to indicate a definite area, partly because of vagueness of geographical

terminology in that period and partly because, in the same paragraph, Lamarck reports that the plant grows in the "East Indies". He undoubtedly meant "eastern India", where Sonnerat did collect, for it is known that Cannabis was introduced into what is now called "East Indies" much later. Sonnerat travelled between 1768 and 1771 in Madagascar, India, Ceylon, the Philippines, Indonesia and China; he spent some time collecting in Pondicherry and southern India.

Lamarck considered his *Cannabis indica* to be a species "very distinct" from *C. sativa*. He reported it to be of a smaller stature, more profusely branched and provided with a much harder (woodier?), almost cylindrical stem. He further stated that the leaves are constantly alternate; the leaflets narrowly linear-lanceolate and very acuminate. The staminate plants have five or seven leaflets; whilst the pistillate plants are commonly three-foliolate, with the leaves near the summit being completely simple. The pistillate flowers he described as having a pubescent calyx and long parallel styles. Because of its hard stem and thin cortex, this species, he maintained, was not capable of furnishing fibres similar to those provided by *Cannabis sativa*. The odour of Lamarck's species was, in his words, "strong and resembling somewhat that of tobacco". In a paragraph following the description of *Cannabis indica*, Lamarck pointed out that the principal virtue of this species lay in the strength of its narcotic properties.

At first glance, a photograph of the specimen on which Lamarck based the name *Cannabis indica* does not show a significant difference from Linnaeus' pistillate specimen No. 1177.2. But when one studies the photograph and the actual specimen (preserved in Paris) critically and against a background of experience with material of Cannabis, the specimen appears to have been taken from

a plant of a much denser and more compact growth than the Linnaean specimen which gives the impression of having come from a rather laxly branched plant. We have also Lamarck's direct remark that the plant is "smaller" and "very much branched", which might well be interpreted to indicate a plant with branches more densely spaced than is the usual condition in what has long been called *Cannabis sativa*.

There were no further developments in Cannabis taxonomy and nomenclature until 1792, when the French botanist Gilibert published *Cannabis foetens* in his *Exercitia Phytologica*. This work, which is not consistently binomial, did not accept Linnaean names. After a very adequate description of what is obviously *Cannabis sativa* (as now typified), he commented mainly on differences in growth habits between the Cannabis that he knew in France and that which he had found in Lithuania. There is no indication that he was attempting to differentiate *Cannabis foetens* from *C. sativa*. The name *Cannabis foetens* must, therefore, be considered a *nomen illegitimum*.

The next event in the nomenclatural history of Cannabis was Sievers' casual enumeration in 1796 of "*Cannabis erratica*" (a binomial dating from pre-Linnaean times) in a list of plants encountered on a trip to Siberia. Since Sievers did not describe this binomial, it represents a *nomen nudum* without scientific status.

Half a century after Linnaeus' publication of *Cannabis sativa*, Stokes described *Cannabis macrosperma* in 1812 in his *A Botanical Materia Medica*. While Stokes legitimately described the concept, no specimen is cited and no locality is given, although, by inference, Asia—and probably India—is indicated. There is little hope that we can now ascertain what Stokes had at hand, but it is probable that he had an unusually large-seeded form of either *Cannabis sativa* or *C. indica*. He distinguished his

Cannabis macrosperma from what he considered to be *C. sativa* (with "nuts lenticular-globose") on the basis of its "oblong" achenes, indicating without explanation of his exact meaning, that the new species "is from *C. indica*".

In 1849, the name *Cannabis chinensis* appeared in a seed catalogue issued by the Montpellier Botanical Garden in France. This binomial is a *nomen nudum* referring probably to a form of cultivated hemp from China.

In Sturm's *Flora von Deutschland* of 1905, E.H.L. Krause published the description of a new species, *Cannabis generalis*, stating that its original home was Asia and, without distinguishing the two concepts, indicating that it represents a species present in the flora of Germany in addition to *C. sativa* and *C. indica*. No type specimen is cited. The description and illustration of *Cannabis generalis* indicate it to be one of the many European variants of the concept that has long gone under the name of *C. sativa*.

In 1911, Houghton and Hamilton published the binomial *Cannabis americana* to refer to "American grown hemp". The binomial is another *nomen nudum*, published without a description and with the clear indication that the authors believed it to be synonymous with *Cannabis sativa*. It need not enter any taxonomic consideration and is mentioned here only because—to the confusion of Cannabis nomenclature—it has been cited in later uncritical pharmacological literature.

Crévost published the binomial *Cannabis gigantea* in 1917 for a kind of hemp grown in Indochina. No description, no citation of specimen, no precise locality were given. The heading of his discussion of hemp in Indochina "*Cannabis sativa* (Lin.) et *Cannabis gigantea*" constitutes a clear indication that he considered the two concepts to be different species. Although referring possibly to a distinct kind of Cannabis, the binomial cannot

enter into any modern consideration of Cannabis taxonomy.

The most recent taxonomic innovation in understanding the genus Cannabis is that of the Russian botanist Janischewsky who, in 1924, published a new species, *C. ruderalis*. This species is reputed to occur in the wild state in the Volga region, western Siberia, central Asia, and now to be widespread, probably in a weedy state, in northern and central Europe and Russia. According to its author, *Cannabis ruderalis* differs from *C. sativa* in a number of characteristics of a morphological nature (darker colored akene covered with a special coat representing the remains of the calyx and with a carunele-like growth at the articulation of the akene) and of a biological nature (the akene falling easily and germinating the following spring).

IV

Preliminary examination of the wood anatomy of material which we collected in Afghanistan and which we believe to represent *Cannabis indica* discloses differences from that of material of *C. sativa* grown in the United States. This research, being carried out by Dr. Loran C. Anderson of Kansas State University, is in its preliminary stages and will be the subject of a later paper. The anatomical differences between these two species are very substantial, and Dr. Anderson feels that some comparable differences in other groups of plants might be given even generic status. In this connection, it should be noted that earlier anatomical investigations in Russia (15) indicated important differences which seemed to point to three "types" of Cannabis. It was also probably anatomical differences which were basic to Lamarck's statement in 1783 that one characteristic which distinguished *Cannabis indica* from *C. sativa* was its much harder, woodier stem.

Plate XXXIII

Cannabis indica, ex

Type specimen of *Cannabis indica* Lam. in the Lamarck Herbarium, Muséum d'Histoire Naturelle, Paris.

Courtesy: Muséum d'Histoire Naturelle.

The differences in growth habit are extraordinary. It is true that, in some localities, cultivated and escaped hemp may be of hybrid origin and/or, in strongly unfavourable habitats, may show some intergradation or ecotypical adaptation away from the norm.

These differences in growth habit we believe to be deeply significant. We have ascertained from our collections and studies in the extensive Mississippi plantation and elsewhere that the characters of growth habit seem to be genetically stable and are not obliterated by edaphic or environmental conditions. *Cannabis sativa* tends to be a tall—sometimes an extremely tall—very loosely branched plant, with the branches distant from one another; the habit of this species can perhaps best be described by the popular term *gangling*. What we consider to represent *Cannabis indica*, on the other hand, is usually a low, conical or pyramidal plant, normally three to four feet tall, very densely branched, with the branches extraordinarily close one to the other. Lamarck, in describing *Cannabis indica*, noted that it differed from *C. sativa* in its smaller stature and its more profuse branching. *Cannabis ruderalis* is reported to be very small, normally up to two feet in height, often only slightly branched or even unbranched at maturity.

We believe also that we can discern a general tendency in leaf variation, although, as in many plants, this character is far from being a conservative one. Furthermore, sufficient comparative studies have not been carried out for the full extent of the reliability of this character to be utilized. We would, however, indicate that the leaflets of *Cannabis sativa* appear, in the main, to be very narrowly linear-lanceolate, with fine and very sharp serrations. *Cannabis indica*, on the other hand, appears generally to have somewhat broader leaflets in relation to their length and to have somewhat coarser serrations

Plate XXXIV

Cannabis sativa (pistillate individual) grown spontaneously in Illinois.
Photograph courtesy Alan Haney.

that are not so sharp or which may be even somewhat obtuse. It is true that this character does not appear to be so striking in Lamarck's type specimen as it seems to be in the very ample herbarium material now at hand. The venation of the leaflets of *Cannabis indica* likewise appears, as a general trend, to be much coarser than in *C. sativa*. In *Cannabis ruderalis*, the perceptible tendency seems to suggest leaflets which are very broad in relation to their length and which are much smaller (i.e., much shorter) than in either of the other two species. Since there is such extreme variation in leaf characters—at least, such *apparent* variation in view of the preliminary nature of our studies—we have preferred not to insert leaf characters into our key. The species can easily be distinguished, we feel, without recourse to characters which at present are not thoroughly investigated.

Furthermore, there may be—and we strongly suspect that there are—significant chemical differences, not only in the cannabinolic content but in other constituents, such as the essential oils, flavenoids and possibly several other classes of secondary compounds. Lamarck suggested as early as 1783 that the content of the intoxicating principal was higher in *Cannabis indica* than in *C. sativa*. In the intervening 200 years, during which the epithet *indica* has been used, there has usually been the inference that it is a more strongly intoxicating form of Cannabis. Unfortunately, however, almost no chemical studies have been made in association with taxonomic studies nor on the basis of voucher specimens. Throughout the modern Russian literature there exists the inference, if not the outright claim, that the cannabinolic content of *Cannabis indica* is higher than that of *C. sativa* and *C. ruderalis*. Pertinent to species differentiation on a chemical basis may be the unexpected, recent discovery, made independently by several workers (6,

Cannabis indica (left: pistillate individual; right: staminate individual) in fields near Kandahar, Afghanistan. Pistillate plant: source of specimen *R.E. Schultes 26505* (Econ. Herb. Oakes Ames). Photograph: R.E. Schultes.

16, 26, 27), that chemical differences in Cannabis appear to be based more on a genetic basis than on environmental or edaphic factors. If this be so, then it may add still another argument for specific differentiation in the genus.

Vavilov and Bukinich, for example, after long field studies in Afghanistan, maintained that Cannabis comprised several species (30). In the *Flora of the U.S.S.R.*, Komarov accepted the polytypic nature of the genus(10). Zhukovsky, in his masterly *Cultivated Plants and their Wild Relatives*, accepts three species of Cannabis and indicates their morphological differences (31). In 1960, Soják asserted that *Cannabis ruderalis* is spreading westward into Europe proper and described × *C. intersita*—a hybrid between *C. ruderalis* and *C. sativa*—on the basis of a Wallich collection in 1831 (23). The *Flora Europaea* accepts a polytypic composition of Cannabis, listing *C. sativa* and *C. ruderalis*—and this in a modern synthetic work which states that "all available evidence, morphological, geographical, ecological and cytological has been taken into consideration in delimiting species. . . . [but which] are in all cases definable in morphological terms" (28).

While we recognize our present incomplete knowledge of characters, we offer the following key to distinguish the several species discussed above.

1) Plants usually tall (up to five to 18 feet), laxly branched Akenes smooth, usually lacking marbled pattern on outer coat, firmly attached to stalk and without definite articulation *C. sativa*

1A) Plants usually small (four feet or less), not laxly branched Akenes usually strongly marbled on outer coat, with a definite abscission layer, dropping off at maturity

2) Plants very densely branched, more or less conical, usually four feet tall or less. Abscission layer a simple articulation at base of akene *C. indica*

2A) Plants not branched or very sparsely so, usually one to two feet at maturity. Abscission layer forms a fleshy caruncle-like growth at base of akene *C. ruderalis*

Plate XXXVI

Cannabis ruderalis Jan. Specimen from the Herbarium of All-Union N.I. Vavilov Institute of Plant Industry (Wir). Soviet Union, Tadzhikskaia SSR. Isfarinski Raion, Kishlak Chorku. V Poseve Pshenitsy. Alt. 1150 m. July 15, 1969. *T.N. Ul'ianova sine num.* (Econ. Herb. Oakes Ames).

V

Acceptance of a polytypic composition of the genus Cannabis should not really lead to so much opposition as it seems to have caused in some botanical circles. As has been pointed out above, this opinion is nothing new and has been substantiated by critical work in wild populations.

But there have been even greater changes in our concepts of Cannabis. For many years, the family to which Cannabis belongs has been uncertain. Early taxonomists tended to put Cannabis in the Urticaceae, the Nettle Family. Then, botanists tended to allocate the genus to the Moraceae, the Fig Family. Now, almost all botanists are in agreement that Cannabis should be classified in a separate family, the Cannabaceae (sometimes incorrectly called the Cannabinaceae or Cannabidiaceae), which includes only two genera: Cannabis and the genus of the hops plant, Humulus. This change in outlook is much more drastic than the change from a monotypic to a polytypic concept of the specific composition of the genus—yet it has come about without the opposition which the proposal of several species instead of one extremely variable species has met in some circles. Furthermore, the change in understanding of the chemical makeup of the genus during the past few years—from four or five to more than twenty-nine cannabinolic structures—has been even more drastic.

VI

The principal field work on Cannabis was carried out more than forty-five years ago. We now have available more sophisticated and interdisciplinary techniques for arriving at taxonomic evaluation of generic, specific and subspecific classification of plants, especially of cultivated plants which have been manipulated and drastically altered through agricultural and horticultural practices extending over thousands of years.

The time is long overdue when a full study of Cannabis taxonomy must be initiated. Cannabis has not received the taxonomic attention commensurate with its position as an ancient domesticate; as an important crop throughout most of man's history; as a genus with many interesting and varied uses; as the source of a narcotic, the use or abuse of which perplexes modern society; and as a plant which, through modern phytochemical investigations, holds promise for even greater significance to the material and cultural evolution of humankind.

VII

The genus Cannabis was described in 1737 by Linnaeus:

Cannabis *Linnaeus* Gen. Pl. (Ed. 1) (1737).

Since the beginning of modern botanical nomenclature in 1753, the following specific epithets have been proposed in Cannabis.

Cannabis americana Houghton et Hamilton in Am. Journ. Pharm. 80 (1908) 17, *nomen nudum.*

Cannabis erratica Sievers ex Pallas Neue Nord. Beytr. 7 (1796) 174, *nomen nudum.*

Cannabis foetens Gilibert Exercit. Phytol. 2 (1792) 450, *nomen illegitimum.*

Cannabis generalis E. H. L. Krause in Sturm Fl. Deutschland, Ed. 2, 4 (1905) 199.

Cannabis gigantea Crévost in Bull. Econ. Indochine, n.s., 20 (1917) 613.

Cannabis indica Lamarck Encycl. 1 (1783) 695.

× *Cannabis intersita* Soják in Novit. Bot. Del Sem. Hort. Bot. Univ. Carol Praga (1960) 20.

Cannabis Lupulus Scopoli Pl. Carniol., Ed. 2, 2 (1772) 263.

Cannabis macrosperma Stokes Bot. Mat. Med. 4 (1812) 539.

Cannabis pedemontana Camp in Journ. N.Y. Bot. Gard. 36 (1936) 114, *nomen nudum in synon.*

Cannabis ruderalis Janischewsky in Uchenye Zap. Gos. Saratov. Univ. 2, pt. 2 (1924) 14.

Cannabis sativa Linnaeus Sp. Pl. (1753) 1027.

Note: This paper is an extension of a lecture delivered by one of the authors (Schultes) on August 29, 1973 at a conference entitled *Cross-cultural perspectives on Cannabis* which preceded the IX International Congress of the International Union of Anthropological and Ethnological Studies, Chicago, Illinois and coordinated by Dr. Vera Rubin, Research Institute for the Study of Man; and on September 5, 1973 at a colloquium entitled *Cannabis sativa—Influence of Genetic and Environmental Factors* in the XXXIII International Congress of Pharmaceutical Sciences, Stockholm, Sweden.

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BOTANICAL MUSEUM LEAFLETS
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ON THE SYSTEMATICS OF THE MONOPODIAL ORCHIDS II.

BY

LESLIE A. GARAY

The primary object of this paper is to clarify the circumscription of the genus *Papilionanthe* Schltr. The genus was monotypic until now, mainly because of the lack of understanding of the delimitation given by Schlechter. In addition to *Papilionanthe* new taxonomic changes are proposed in sundry genera, all arranged in alphabetical sequence, following the pattern established in the first contribution published in the Botanical Museum Leaflets, Harvard University 23: 149–212, 1972.

Papilionanthe Schltr. in Orchis 9: 78, July 15, 1915.

Syn.: *Vanda* Sect. *Teretifoliae* Pfitz. in Engl. & Prantl, Natuerl. Pflanzenf. 2, pt. 6: 214, 1889.
Vanda Sect. *Teretivanda* O. Ktze. in Post & Ktze., Lex. Gen. Phan. 584, 1903, *nom. illegit.*

Type: *Dendrobium teres* Roxb.
Aerides Sect. *Phalaenidium* Pfitz. in Engl. & Prantl, Natuerl. Pflanzenf. 2, pt. 6: 217, 1889.

Type: *Aerides Vandarum* Rchb.f.

This genus is characterized by a short, stout, non-pyramidal column, basally extended into a long and prominent foot which is continuous without articulation with the variously 3-lobed lip. The lateral lobes of the

lip are either parallel with or enfolding the column. Pollinia 2, sulcate on broadly triangular to subquadrate stipe; viscidium large. Rostellum elongate.

Plants epiphytic with terete leaves and axillary one- to few-flowered inflorescence. Flowers small to large, often showy.

It is quite surprising that the genus *Papilionanthe* has been ignored entirely in floristic works. Schlechter was justified in separating it from the genus *Vanda* and in determining its intermediary position between *Vanda* and *Aerides*. I have already pointed out (Bot. Mus. Leafl. Harvard Univ. 23: 158, 1972) that the Section *Phalaenidium* of *Aerides* must be combined with the genus *Papilionanthe*. A comparison of the longitudinal sections of the column and lip of *Aerides cylindrica* Lindl. and *Papilionanthe teres* (Roxb.) Schltr. shows them completely identical. As a matter of fact, in columnar structure and in the elongate rostellum, *Papilionanthe* is much closer to *Aerides* than to *Vanda*. Schlechter's precise observations have often been dismissed because he was and still is considered a "great splitter". In my many years of acquaintance with Schlechter's works, I begin to feel quite strongly that the distinction between "splitters" and "lumpers" rests not in one's outlook and approach to the subject of systematics, but rather in one's power of observation of details and the ability of evaluating their significance. The flowers of *Aerides Vandarum* Rchb.f. and *Aerides Biswasianum* Mukerjee have somewhat narrower stipes than are found in other species, but in every other aspect they agree with the circumscription of the genus.

Key to the Species

1. Lateral lobes of lip linear 2
1a. Lateral lobes of lip broad 6
2. Midlobe of lip sessile with a broad base 3
2a. Midlobe of lip with a narrow, cuneate base 4
3. Lip with entire margin except at tip . . . . . *P. tricuspidata*
3a. Lip with a coarsely dentate margin throughout . *P. pedunculata*
4. Stem pendulous; lateral lobes of lip subulate, deeply biparted . . . . . *P. uniflora*
4a. Stem erect to suberect; lateral lobes of lip at most erose-denticulate 5
5. Midlobe of lip deeply cleft, entire; flowers lilac . *P. Biswasiana*
5a. Midlobe of lip biparted, erose-denticulate; flowers white . . . . . *P. Vandarum*
6. Inflorescence longer than leaves; midlobe of lip broadly 3-lobed . . . . . *P. Hookerana*
6a. Inflorescence as long as or shorter than lip; midlobe of lip entire or more or less 3-lobed 7
7. Flowers large, showy; midlobe of lip cuneate-unguiculate, divergingly bilobed . . . . . *P. teres*
7a. Flowers small, not showy; midlobe of lip sessile, entire . . 8
8. Petals wider than sepals . . . . . *P. subulata*
8a. Petals narrower than sepals 9
9. Lateral lobes of lip subquadrate-truncate; midlobe retuse . . . . . *P. Sillemiana*
9a. Lateral lobes and midlobe of lip obtuse 10
10. Inflorescence 2- to 4-flowered, as long as leaves; petals obliquely subspathulate . . . . . *P. flavescens*
10a. Inflorescence 1-flowered, much shorter than leaves; petals sessile . . . . . *P. Greenii*

List of Species

Papilionanthe Biswasiana (Ghose & Mukerjee) Garay, *comb. nov.*

Basionym: *Aerides Biswasiana* Ghose & Mukerjee in Orch. Rev. 53: 124, 1945.

Papilionanthe flavescens (Schltr.) Garay, *comb. nov.*

Basionym: *Aerides flavescens* Schltr. in Fedde Rep. 19: 382, 1924.

Papilionanthe Greenii (W.W.Sm.) Garay, *comb. nov.*

Basionym: *Aerides Greenii* W.W.Sm. in Rec. Bot. Soc. Ind. 4: 271, 1911.

Papilionanthe Hookerana (Rchb.f.) Schltr. in Orchis 9: 80, 1915.

Basionym: *Vanda Hookerana* Rchb.f. in Bonpl. 4: 324, 1856.

Papilionanthe pedunculata (Kerr.) Garay, *comb. nov.*

Basionym: *Aerides pedunculata* Kerr in Journ. Siam. Soc. Nat. Hist. Suppl. 10: 59, 1935.

Syn.: *Vanda Masperoae* Guillaum. in Bull. Mus. Nat. Paris ser. 2, 22: 628, 1951.

Papilionanthe Sillemiana (Rchb.f.) Garay, *comb. nov.*

Basionym: *Thrixspermum Sillemianum* Rchb.f. in Gard. Chron. n.s. 17: 524, 1882.

Syn.: *Aerides Sillemiana* (Rchb.f.) Garay in Bot. Mus. Leafl. Harv. Univ. 23: 159, 1972.

Papilionanthe subulata (Koen.) Garay, *comb. nov.*

Basionym: *Epidendrum subulatum* Koen. in Retz. Obs. Bot. 6: 50, 1791.

Syn.: *Limodorum subulatum* (Koen.) Willd., Sp. Pl. 4: 126, 1805.
Aerides cylindrica Lindl., Gen. and Sp. Orch. Pl. 240, 1833.
Aerides subulata (Koen.) Schltr. in Fedde Rep. 19: 382, 1924, not Lindl. 1833.

Papilionanthe teres (Roxb.) Schltr. in Orchis 9: 78, 1915.

Basionym: *Dendrobium teres* Roxb., Fl. Ind. 3: 485, 1832.

Syn.: *Vanda teres* Lindl., Gen. and Sp. Orch. Pl. 217, 1833.

Papilioanthe tricuspidata (J.J.Sm.) Garay, *comb. nov.*

Basionym: *Vanda tricuspidata* J.J.Sm. in Bull. Jard. Bot. Buitenz. ser. 2, 13: 48, 1914.

Papilionanthe uniflora (Lindl.) Garay, *comb. nov.*

Basionym: *Mesoclastes uniflora* Lindl., Gen. and Sp. Orch. Pl. 45, 1830.

Syn.: *Luisia uniflora* (Lindl.) Bl. in Rumphia 4: 50, 1849.
Aerides longicornu Hook.f., Fl. Br. Ind. 6: 44, 1891.
Aerides uniflora (Lindl.) Summerh. in Kew Bull. 10: 588, 1956.

Papilionanthe Vandarum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Aerides Vandarum* Rchb.f. in Gard. Chron. 997, 1867.

Aërangis Rchb.f. in Flora 48: 190, Apr. 27, 1865.

Type: *Aërangis flabellifolia* Rchb.f.

The characters of this genus have already been discussed in the first paper of this series. Recently I had an opportunity to study live material from Madagascar of *Angraecum calligerum* Rchb.f. which agrees completely with the type collection. For a long time I considered

it to be conspecific with *A. Ellisii* Rchb.f., based on Reichenbach's drawings of both species and have so stated it in Kew Bull. 28: 506, 1974. However, the fresh flowers undoubtedly establish it as a good species due to quite a distinct habit and larger floral segments.

Aërangis calligerum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Angraecum calligerum* Rchb.f. in Gard. Chron. ser. 3, 2: 552, 1887.

Sarcoglyphis Garay in Bot. Mus. Leafl. Harv. Univ. 23: 200, 1972.

Type: *Sarcanthus mirabilis* Rchb.f.

At the time I published the genus *Sarcoglyphis*, *Saccolabium fimbriatum* Ridl. was known to me only through a rather crude drawing by Ridley. Since then I have had the opportunity to examine the holotype specimen and it is undoubtedly referable to *Sarcoglyphis* rather than to *Pennilabium* to which it has been allocated previously.

The characters of the genus *Sarcoglyphis* have already been discussed in the former paper.

Sarcoglyphis fimbriatus (Ridl.) Garay, *comb. nov.*

Basionym: *Saccolabium fimbriatum* Ridl. in Journ. Str. Br. Roy. As. Soc. 54: 52, 1909.

Syn.: *Pennilabium fimbriatum* (Ridl.) Garay in Bot. Mus. Leafl. Harv. Univ. 23: 189, 1972.

Thrixspermum Lour., Fl. Cochinch. 2: 519, Sept. 1790.

Type: *Thrixspermum Centipeda* Lour.

The characters of this genus have already been disdussed in the first paper of this series. An examination of the type of *Sarcochilus tahanensis* Ridl. necessitates the following transfer.

Thrixspermum sarcophyllum Garay, *nom. nov.*

Basionym: *Sarcochilus tahanensis* Ridl., Fl. Malay Penins. 4: 180, 1924, not *Thrixspermum tahanense* Carr, 1930.

Syn.: *Sarcochilus crassifolius* Ridl. in Journ. Fed. Malay. St. Mus. 6: 182, 1915, not Rolfe 1894.

Vandopsis Pfitzer in Engl. & Prantl., Natuerl. Pflanzenf. 2, pt. 6: 210, March 1889.
Type: *Fieldia lissochiloides* Gaud.

This genus is characterized by the short, footless column to which the lip is firmly adnate. Lip geniculately bent, more or less canaliculate, at most gibbous at base. Pollinia 2, deeply sulcate in unequal pairs, more or less sessile on broadly ligulate stipe; gland transverse, prominent. Sepals and petals spreading.

Vanda Parishii Rchb.f. is commonly referred to the genus *Vandopsis*, but because of the elongate and arcuate column, the movable hinged lip and the shape of the pollinia, it must be regarded a genus of its own, *Hygrochilus* Pfitz., as has already been suggested by Pfitzer.

Vandopsis shanica (Phillimore & Smith) Garay, *comb. nov.*

Basionym: *Stauropsis shanica* Phillimore & Smith in Rec. Bot. Soc. Ind. 4: 281, 1911.

Xenikophyton Garay, *gen. nov.*

Etymology: *xenikos* = strange, *phyton* = plant, in reference to the strange admixture of characters from *Cleisomeria* and *Sarcophyton*..

Type: *Saccolabium Smeeanum* Rchb.f.

Sepala petalaque similia, libera; sepalum posticum petalis conniventibus, galeam formantibus; sepala lateralia patentia. Labellum sessile, valde carnosum, basi scrotiforme, apice recurvum, strumosum, ostio subclauso. Columna humilis, crassa, utrinque crasse obtuseque, obscure brachiata; clinandrium valde excavatum, dorsaliter reclinatum; stigma verticale marginatum, anguste ellipticum; rostellum verticale, arrectum, alte bifidum. Anthera mitrata. Pollinia 4, libera, globosa, stipiti lineari, replicatae, sine caudiculis distinctis affixa; glandula satis magna, elliptica.

Epiphytica, erecta; foliis distichis, carnoso-coriaceis, articulatis; vaginis arpophyllaceo-rugosis; inflorescentiis erectis, ramulosis, multifloris; floribus carnosis, minutissimis.

Vegetatively the plants of this genus resemble those of the genus *Cleisomeria*, but the pollinia are very different. It is perhaps closest to the genus *Sarcophyton*, but the lack of a backwall callus immediately separates the two.

The erect, large and prominently bifurcate rostellum and the vertical stigma, resembling the structure found in *Eparmatostigma*, easily identifies this genus.

Xenikophyton Smeeanum (Rchb.f.) Garay, *comb. nov.*

Basionym: *Saccolabium Smeeanum* Rchb.f. in Gard. Chron. ser. 3, 2: 214, 1887.

Syn.: *Rhynchostylis latifolia* Fischer in Kew Bull. 358, 1927.

SWARTZ FLORA INDIAE OCCIDENTALIS

Volume III

BY

Leslie A. Garay

The third volume of Swartz's Flora Indiae Occidentalis is generally accepted to have been published in 1806, because no review of it appears before that date. The evidence presented below strongly suggests that volume 3 was issued at least in two parts: Part 1 comprising pp. 1231 to 1566 and Part 2 comprising pp. 1567 to 2018 plus the index. It is possible that Part 2 was issued in two sections, pp. 1567 to 1758 and pp. 1759 to 2018, because at the bottom on page 1758 the catch word HYME- indicates that another HYMENOPHYLLUM will follow. Yet page 1759 starts with MUSCI FRONDOSI.

Pages 1231–1566 cover descriptions of plants belonging to the Linnaean classes of Diadelphia, Syngenesia

and Gynandria. Of these the Gynandria is of special interest, for Swartz published a comprehensive treatise of Gynandria under the title "Genera et Species Orchidearum Systematice redactarum," in Schrader, Neues Journal für die Botanik, vol. 1: 1–108, March 1805. Throughout the pages, under the generic names which appear in Flora Indiae Occidentalis, a reference to the actual page is given: e.g., p. 49 "Neottia. *Jacq. Sw.* flor. ind. occ. 3, p. 1397."

The most crucial information is to be found on p. 95 under *Dendrobium polystachyon*, where Swartz cites "Cranichis luteola. *Fl. ind. occ.* 1433" in synonymy. This reduction together with a summary of West Indian Orchids discussed in Schrader's Journal in 1805 is added as a postscript to Flora Indiae Occidentalis, vol. 3: 1989–1998.

It may be argued that Swartz had page proof in his hand when he prepared the article for Schrader's Journal in 1804. However, further evidence indicates that part 1 of volume three must have already been published and distributed in 1804. The evidence is to be found in Willdenow, Species Plantarum, vol. 4, part 1, published in 1805. In that part Willdenow includes every new orchid name and combination which Swartz had proposed in his Flora with the actual page references: e.g., "Neottia calcarata . . . Swartz fl. ind. occid. 3, p. 1413." Willdenow also includes *Cranichis luteola* Sw. in synonymy under *Dendrobium polystachyon* Sw. This information, however, he could have only obtained from Schrader's Journal. The fact that Willdenow had an actual copy of Swartz's Flora Indiae Occidentalis vol. 3, pt. 1 in hand is further supported by his citing the actual page numbers of *Aristolochia obtusata*, p. 1565 and *Aristolochia grandiflora*, p. 1566, neither of which could have been obtained from any other source!

Thus, it is proposed that the publication date of Swartz, **Flora Indiae Occidentalis, vol. 3, pp. 1231-1566** be recognized as of **1804.**